EDISON
ELECTRIC INSTITUTE
BULLETIN

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OCTOBER, 1937

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EDISON ELECTRIC INSTITUTE

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF JULY

	1937	1936	%
Kilowatthours Generated* (net)			
By Fuel	6,704,544,000	6,219,551,000	+ 7.8
By Water Power	3,160,395,000	2,819,093,000	+12.1
Total Kilowatthours Generated	9,864,939,000	9,038,644,000	+ 9.1
Additions to Supply			
Energy Purchased from Other Sources	285,518,000	167,875,000	+70.1
Net International Imports	112,108,000	112,526,000	− 0.4
Total	397,626,000	280,401,000	+41.8
Deductions from Supply			
Energy Used in Electric Railway Departments	41,577,000	42,036,000	− 1.1
Energy Used in Electric and Other Departments	107,917,000	113,519,000	− 4.9
Total	149,494,000	155,555,000	− 3.9
Total Energy for Distribution	**10,113,071,000**	**9,163,490,000**	**+10.4**
Energy Lost in Transmission, Distribution, Etc.	**1,657,303,000**	**1,644,387,000**	**+ 0.8**
Kilowatthours Sold to Ultimate Customers	**8,455,768,000**	**7,519,103,000**	**+12.5**
Sales to Ultimate Customers (kwhrs)			
Domestic Service	1,370,562,000	1,159,479,000	+18.2
Commercial—Small Light and Power (Retail)	1,497,097,000	1,317,098,000	+13.7
Commercial—Large Light and Power (Wholesale)	4,944,195,000	4,361,677,000	+13.4
Municipal Street Lighting	140,262,000	171,263,000	−18.1
Railroads—Street and Interurban	332,544,000	342,253,000	− 2.8
Railroads—Electrified Steam	100,488,000	98,843,000	+ 1.7
Municipal and Miscellaneous	70,620,000	68,490,000	+ 3.1
Total Sales to Ultimate Customers	8,455,768,000	7,519,103,000	+12.5
Total Revenue from Ultimate Customers	$179,637,400	$167,671,900	+ 7.1

DURING TWELVE MONTHS ENDING JULY 31st

Kilowatthours Generated* (net)			
By Fuel	73,134,410,000	63,398,689,000	+15.4
By Water Power	39,965,270,000	36,513,057,000	+ 9.5
Total Kilowatthours Generated	113,099,680,000	99,911,746,000	+13.2
Purchased Energy (Net)	4,031,117,000	3,262,641,000	+23.6
Energy Used in Electric Railway and Other Departments	2,122,676,000	2,179,842,000	− 2.6
Total Energy for Distribution	**115,008,121,000**	**100,994,545,000**	**+13.9**
Energy Lost in Transmission, Distribution, Etc.	**17,918,945,000**	**16,797,410,000**	**+ 6.7**
Kilowatthours Sold to Ultimate Customers	**97,089,176,000**	**84,197,135,000**	**+15.3**
Total Revenue from Ultimate Customers	**$2,146,336,800**	**$1,989,016,900**	**+ 7.9**
Important Factors			
Percent of Energy Generated by Waterpower	35.3%	36.5%	
Domestic Service (Residential Use)			
Average Annual Consumption per Customer (kwhr)	770	701	+ 9.8
Average Revenue per Kwhr (cents)	4.51¢	4.84¢	− 6.8
Average Monthly Bill per Domestic Customer	$2.89	$2.83	+ 2.1

BASIC INFORMATION AS OF JULY 31st

Generating Capacity (kw)—Steam	24,084,471	24,052,100
—Waterpower	9,520,747	9,011,800
—Internal Combustion	615,177	499,400
Total Generating Capacity in Kilowatts	34,220,395	33,563,300
Number of Customers		
Farms in Eastern Area (Included with Domestic)	(857,934)	(632,150)
Farms in Western Area (Included with Commercial—Large)	(290,302)	(234,738)
Domestic Service	22,090,401	21,356,627
Commercial—Small Light and Power	3,845,280	3,779,743
Commercial—Large Light and Power	562,803	509,072
Other Ultimate Customers	69,726	61,781
Total Ultimate Customers	26,568,210	25,707,223

*By courtesy of the Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 5 OCTOBER, 1937 No. 10

The Interdependence of the Various Branches of the Electrical Industry

By Floyd L. Carlisle

Chairman of the Boards of Consolidated Edison Company of New York, Inc., and Niagara Hudson Power Corporation

An address before the International Association of Electrical Leagues, New York, Oct. 1, 1937

I ACCEPTED the invitation to address this luncheon several weeks ago with a feeling that at long last my remarks would be made to a group of men all of whom worked in the important enterprises that collectively constitute the electrical industry. Our knowledge is practical and based upon experience. We are idealists and are proud of the great industry of which we are a part. We are conscious of its public character and responsibilities. We are devoting our lives to that which is of itself probably the most useful business in our present-day civilization.

It is a great pleaure to see present so many members of the Electrical Association of New York here to welcome the delegates of the International Association of Electrical Leagues and to join with them in this Conference. Of course, it is unnecessary to say that this city is not one of the wonders of the world—some say that the real America starts west of the Appalachian Mountains—that New York is nothing but a great foreign city, and that few of its inhabitants ever go west of Newark. But in Paris this summer, a much traveled Frenchman told me that to the European, New York was America, and that they were all coming to our World's Fair in 1939. Their prayer was to see New York, and not to die, but to go back home and copy it. As Lord Balfour said, our skyscrapers are cathedrals, and our spirit infinite change and progress.

It is very fitting that the delegates and representatives of the Electrical Leagues

MR. CARLISLE

should convene in New York, the city that power built. In no place in the world is so much important business activity concentrated, as upon the little narrow island of Manhattan. To meet that congestion, New York has had to go into the depths of the island, far below street levels, and push its buildings into the clouds.

Much deeper underground than in other cities are our subways. There are places where three layers of tracks are operated, piled one upon another. In this underground are the huge sewers, water mains, telephone and telegraph wires, gas and steam pipes, and through it all the electric cables and networks without which nothing could move. Overhead are office buildings, many daily housing a working population larger than the population of many cities in the country. The elevators are but perpendicular railroads. All this was possible because of electric power.

I could carry this theme indefinitely. My only purpose in mentioning it is to dramatize the importance of our business, and to point with justifiable pride to the electric industry's part in the making of the world's greatest city and to its constant service.

All these groups equally contributed to this great work. Of the power companies I will modestly say that they were proud to share with the electrical machinery manufacturers, wholesale and retail selling groups, and electrical contractors, the honor of achievement. Like everything in our complex modern social order it is a composite achievement. Labor of every kind — highly skilled, white collar, common labor—all played their important part in it.

When the Consolidated Edison Company of New York orders a large electric generator, it starts in motion a chain of far-reaching events. Some $10,000,000 of (idle) capital starts to work. At least half of this capital is provided through the sale of bonds and many of these will be bought by savings banks utilizing the savings of a vast number of persons in all walks of life. The rest of the capital will be raised through the sale of preferred and common stocks to

hosts of other investors. The interest paid upon the bonds of the Company and the dividends paid upon the stocks thus pass into the widest use.

The order for the generator becomes a source of large taxable income to governments. When completed and installed it will be taxed as real estate by the City of New York. School teachers, policemen, firemen, street cleaners, judges, the Mayor, nurses in the city hospitals—all will be paid in part because this order was placed. New streets, parks, playgrounds, school houses will be possible in part because of this order. Many further taxes start, which go to the national and state governments as well as to the City of New York.

Twenty per cent of the money paid to these local companies for electricity, gas and steam by its purchasers, must be paid out again in taxes. Much of the other 80% is also taxed. From the salaries and wages paid our employees, another huge slice is cut. Coal, oil and a hundred other raw materials are subject to various taxes before they are consumed in the plant. Interest on bonds and dividends in the hands of their owners again feed taxes to carry on the costs of governments.

The fortunate electrical manufacturer who received the order will at once cover his requirements of metals and thereby contribute to keeping men in western mining towns employed through the winter. In Pittsburgh or Schenectady or Chicago, several hundred men will be certain of steady work, at a high compensation for over a year. The builder and contractor will be studying the blue prints because the machine must have a foundation and a roof over its head. It must have boilers and switchboards and dozens of things, all of which are stimulation to the Nation's economic well-being. Railroads will be called upon to move the ore east, to transport numerous items of equipment and to deliver the equipment when finished.

The company, of course, would not have ordered the generator unless it expected to sell the output of the plant. Unlike other products, this plant output cannot be delivered on a truck and stored until needed. There must be lights and machines to use its production. The manufacture, and distribution of these things is the primary interest of this Convention. The uses to which electricity can be put by the press of a button has the magic of Aladdin's Lamp licked a million ways—an infinite variety of lamps for light, health, and heat; the machinery for servicing foods, such as refrigerators and ranges; the machinery for servicing cleaning—washers, irons, dryers; the machinery of ventilation; the machinery servicing entertainment—radios and motion pictures. There are many others.

You can take the very great achievement of the automotive industry, of aviation, of motion pictures, and they pale by comparison with the composite achievement of our business.

For more than fifty years of our life our industry has been progressively gaining. The depression slowed but did not stop its stride. From the year 1932 to the present, the average residential use of electric current has increased from 597 kilowatt hours to 770 kilowatt hours, or 29%, and the selling price dropped from an average of 5.57c. to 4.51c. per kilowatt hour or 19%. In the manufacturing and distribution field equally successful and socially beneficial results were achieved. I illustrate by the domestic refrigerator. In 1932, 798,000 were sold at an average of slightly under $200. In 1936, 2,080,000 were sold at under $165. This is an increase in the number sold of 160% and a drop in the unit cost of 33%.

The results of our efforts are that here in the United States the per capita use of electricity is 68% larger than in Great Britain, 70% larger than in Germany, 91% larger than in France and 156% larger than in Italy, according to a recent report of the National Resources Committee.

Our business has not come by sitting and waiting for it. We have gone after and gotten it. The promotional efforts of the groups here represented have been carried on cooperatively and rank among the most aggressive, courageous and intelligent in all American industry. Rates were reduced in the face of declining revenues, new appliances to which the public was not accustomed were manufactured and offered at prices which could only be warranted by large volume sales. We all spent huge sums of money on newspaper and magazine advertising, radio programs, and scores of ingenious promotional schemes, at a time when the business skies looked black and ominous. The success of the Better Light-Better Sight campaign and the Kitchen Modernization campaign bears testimony to this. Based on such results, the campaigns more recently launched, including the Adequate Wiring program, the Commercial Electric Cooking program, the Electric Water Systems program and the Electric Water Heating program, will undoubtedly be successful.

This is cooperation of the finest kind and should be continued. These activities must be looked at from a national viewpoint; each group must try to be broad-gauged in appreciating the other's policies and problems. To promote national programs, local organizations are necessary and every branch of the industry should encourage local promotional agencies such as the leagues represented here today.

Along this line I have been very much interested in looking over the results of a survey just completed of 20 such leagues located in the principal trading areas of the country—including the cities of Cleveland, Kansas City, Chattanooga, Indianapolis, Washington, Los Angeles, New Orleans, Philadelphia, St. Louis, Buffalo, Chicago, Boston and New York. The survey disclosed that the population served by these twenty leagues aggregated some thirty-four million inhabitants, almost 26% of the nation's population. The residential meters served within the sphere of the influence of these twenty leagues were in excess of seven million six hundred thousand, almost 35% of the nation's total; the commercial and industrial meters exceeded 1,280,000 in number, or over 30% of the nation's total. The promotional fields in which these twenty leagues had engaged or were engaging in furthering both national industry programs and local programs covered Adequate Residential Wiring, Better Light-Better Sight, Commercial Electrification, Electrical Housewares, Industrial Modernization, Kitchen Modernizing, Sales Financing, Periodical and Permanent Exhibits, Radio Promotion, Laundry Equipment Promotion, Domestic and Commercial Refrigeration, and a host of others too numerous to detail.

But the most significant thing to me was the low cost of these activities. According to this survey the cost of cooperatively promoting all these electrical endeavors in the twenty trading areas was but 16.3c. per meter per year, paid for proportionately by the interests participating in the League's membership. In this connection I might mention that the twenty leagues surveyed had a total membership of 971 manufacturers, 191 utility companies, 336 wholesalers, 864 contractors, more than 1,500 dealers,

and about 500 miscellaneous other industry members. Some of the leagues operated within metropolitan areas only, others took in an entire state and some even embraced as many as three states as their field of operation, with local chapters in important centers.

Modern society, because almost every one in it exchanges his products or services for the things which he consumes, lives and prospers by reason of the volume and velocity of production and consumption of goods and services. A high turnover means high wages, healthy employment both of labor and capital and high standards of living.

The United States has reached its high state and standards, far surpassing that of other and less favored lands, almost entirely through our much greater volume and velocity of turnover. We have accomplished this by mass production and distribution, and a wider and more skillful use of our banking and credit machinery. It is not by accident that with a small fraction of total world population we use almost half of the total electricity produced, and own half of the world's automobiles, and what are luxuries in foreign lands are available to and used by the greater part of our people. This has been made possible by the happy combination of abundant raw materials, a stimulating climate, our own great internal market in which no tariff existed, a mixture of the best of European races, an absence of caste and inhibitions that are natural in older countries, free education, free speech and free religion, a form of government that has given every incentive to private thrift, initiative and ability, with the door of opportunity so wide that the leaders of our economic life are almost without exception men who have risen from the bottom to the top upon no basis except character, merit and ability.

In New York we have a constant stream of visitors from the rest of the world, inspecting our plants and methods of operation. They come to learn and copy, not to criticize. What England is trying to do through the British Grid, we took in our stride and have accomplished.

I do not mean that all will be smooth sailing in the future. The fair share of labor in the economic process and its future relationship to management—not to forget government—are very much in flux at the moment. The mere shortening of hours and raising wages is not the solution. More goods at possibly lower prices is the sound way. A spiral of rising wages and prices is to be avoided at all hazards. It was that spiral which nearly wrecked the German Republic in 1923, and made a laborer's pay of even a billion marks per day utterly worthless. France, through unsound experiments with hours and wages, and unwise government spending, is now seeing her money rapidly lessen in value. It is 50% less valuable today than when Charlie Stephens and I were in Paris in June.

The way to manage a business is to believe in it. When I get the chronic "blues" somebody else will take my job. True, taxes are too high, the national budget is not balanced, your wife wants an expensive fur coat, and your son may be shortly busted out of college. But forget it and do what we did in the worst of the depression. Work harder and sell more goods. Swell the volume and velocity of turnover and see that our business gets its share. There is little of heroics, and none of the glamour and publicity of great public enterprises in this work, but it is part and parcel of the solid permanent foundation upon which our whole economic structure and the prosperity of our country really rests.

Prize Awards Offered for 1938

POSTERS giving the rules and conditions governing the entries for the several prize awards to be administered by the Edison Electric Institute will be mailed to electric light and power companies during the month of October.

Mr. H. P. Liversidge, Chairman of the Prize Awards Committee, states that the awards and conditions for 1938 will be substantially the same as in 1937. Prizes consist of the Byllesby, Forbes, Lindemann and McGraw prizes to individuals for papers on subjects relating to the electric light and power industry and the Charles A. Coffin, the Augustus D. Curtis, the George A. Hughes and the Thomas W. Martin awards to companies and individuals for accomplishments in specified activities.

Papers entered for the first group of prizes must be forwarded to the Institute by March 1, 1938, and entries for the second group by April 1, 1938.

The prizes to individuals are as follows:

BYLLESBY PRIZE . . *Accounting*

Cash prizes of $100, $50 and $25 donated by Public Utility Service Corporation, in memory of Colonel H. M. Byllesby, for the three most meritorious papers on any Accounting subject relating to the Electric Light and Power Industry.

FORBES PRIZE . . *Public Relations*

A cash award to be donated by Mr. B. C. Forbes, Editor, *Forbes Magazine,* for the most meritorious paper dealing with the subject of Public Relations in the Electric Light and Power Industry.

LINDEMANN PRIZE . . *Electric Cookery*

Cash prizes of $150, $100 and $50 donated by Mr. A. L. Lindemann, President, A. J. Lindemann and Hoverson Company, for the three most meritorious papers dealing with the Advantages of Electric Cookery for Domestic Purposes.

McGRAW PRIZE . . *Engineering*

Cash prizes of $250, $150 and $100 donated by Mr. James H. McGraw, Honorary Chairman, McGraw-Hill Publishing Company, for the three most meritorious papers on any Engineering or Technical subject relating to the Electric Light and Power Industry.

Any person employed by an electric light and power company is eligible to enter the competitions. No person is eligible to win two years in succession the identical prize or lower prize of the same award, but is eligible for a higher prize of that award. Papers must be the original work of the author or authors, prepared exclusively for this competition. Papers may be of any length, and pen-and-ink drawings or photographs suitable for reproduction may be included. Papers should be typewritten on one side only, and submitted in duplicate.

The first page of the manuscript must give the following information: the name of the prize for which the paper is submitted, title of the paper, name of author, name and address of employing company, title or character of position and home address. One paper may not be submitted for more than one prize.

Papers not receiving awards will,

(*Continued on page* 410)

Selective Selling—Its Effects on Social and Economic Standards

By George E. Whitwell
Vice-President, Philadelphia Electric Company

Before the Boston Conference on Distribution, Hotel Statler, Boston, Sept. 21, 1937

FOR the purpose of this presentation "selective selling" may be defined as "the selling of articles or devices directly to definitely selected prospective buyers." The articles and devices are usually those classed as "specialties." The selling method generally involves having the salesman go to the customer as contrasted with sales that are made to those who go themselves to stores. Selective selling requires very specific knowledge of markets, is the method of the rifle rather than the shotgun and, generally, though not always, is applied to new products or new uses for existing products, both being the usual results of new processes and materials.

Consequently, I am not talking only of the effects of selective selling on social and economic standards; I want to discuss the broader subject of "Expanded Production and Standards of Living Through New Processes, New Products and New Uses." If this subject sounds somewhat terrifying, other words can be used to simplify it. The same thought is expressed by "Sound Economics Alone Results in Greater Humanitarianism," or "Social Progress is Dependent upon Sound Economics." After all, expanded production, with its new processes, new products and new uses, is but another way of describing sound economics, and higher standards of living are nothing but social advance and the improvement of humanity's condition. Selective selling is inextricably woven into the fabric of new processes and new uses; its effect, consequently, on social and economic standards is profound.

Many causes have been given for the world depression. Regardless of what they all may have been, it is generally conceded that the chief cause was a sharp and sudden decrease in the volume and velocity of trade. But even when this decrease in volume and velocity of trade reached its maximum point, there still remained in this country, to its advantage, natural resources, huge internal trade, wide private ownership of property and a safe distance from European troubles. The problem of getting business wheels turning again so that we could crawl painfully but slowly and surely out of the depression, while not to be as simply accomplished as these brief words of mine might indicate, depended upon increase in volume and velocity of trade. This called for expanded production, for new processes, new products, and new uses for these products. Given these new things and methods, prices could remain at satisfactory levels, and the volume and velocity of trade would increase. With wider distribution of better goods at greater values, higher standards of living should follow.

To prove, however, that good economics breeds greater humanitarianism or that expanded production and higher standards of living go hand in hand, I must quote, in large part, from the experience of my own Company and crave your indulgence if I seem to be speaking too concretely on a policy and a program followed by a single institution. Many other business organizations have done the same but I do not know the facts concerning most of them, and facts are needed if it is to be proved that sound economics are still good guide-posts to follow when, as a Nation, we are also solving some of our social problems.

Let us go back to 1932. Philadelphia, like most places, in that year was not a particularly happy place in which to live. The problems of the utility company seemed very great but the United States still had its natural resources, its huge internal trade, its wide private ownership of property, and its security from embroilment in Europe's difficulties. Philadelphia, too, had its own natural geographic advantages, its large diversity of essential industries, and its wide private ownership of property. It seemed as if the only hope of emergence from depression, for the local electric utility, was the expanded production of electricity, the development of greater use of new electricity-involving processes and products, consequent reduction in the price of our kilowatt-hours and intensive selective selling to our customers.

Light is an example with which all of you are familiar. Light itself seems silly to talk about, because it is something that we have with us every day; something that is at our disposal at the flick of a switch; yet, in 1932 people were not using light. It was imperative that we build up an expanded use of this well-known necessity. Out of this effort came a knowledge of a definite relationship between sight and light. While you may say that sight is something that should not have been brought into any commercial problem, I say to you that if anything could be done that would improve the eyesight and vision of a nation, then that is something which, while commercially advantageous, also has a distinct flavor of humanitarianism.

To make a long story short, it was decided that portable lamps themselves were then inadequate. In the last three years there has grown up a brand new industry in the association of better light with better sight. There has been developed a large variety of reading lamps, scientifically designed by illuminating engineers, of which, in three years, more than three million have been sold. Here we have an illustration of an expanded use, for light, of an old product, electricity, plus the development of a brand new industry, namely the building of a satisfactory lamp for people to read by. Social results have been many. Selling of a peculiarly selective type was the factor that largely made possible these results.

Turning from light, let us consider the electric range and the electric water heater. In 1931, there were probably 6000 or 7000 electric ranges in use in our territory of something more than 2,000,000 people, and there were only

a handful of electric water heaters. It seemed a very difficult problem to have to pick two devices, neither of which had any public acceptance, to use as leaders, by means of which to climb out of some of the difficulties in which we found ourselves. Yet in six years the public in our area has spent about four million dollars for some 40,000 electric ranges and electric water heaters—all the result of intensive selective selling. The consequences have been the expansion of the industrial concerns that make these devices, work for the contractors who install them, and decidedly a new use for an old product, but, also, there has evolved definitely a higher standard of living and greater satisfaction, convenience, comfort and labor-saving for those who have bought these ranges and water heaters.

What else has this range and water heater program meant? In six years, five of them during a depression, the increased use of residential electricity made it possible for our company to decrease the average cost of electricity in homes by almost 2 cents a kilowatt-hour, or practically 30 per cent. From a figure of about 6 cents which it was in 1931, it has been decreased to about 4 cents. What other commodity has a like record? Yet it didn't just happen. Selective selling had to be accomplished.

What else has occurred? During that same period the average residence customer has increased his use of electricity for labor-saving devices that electricity brings into the home by almost 40 per cent; yet his annual payments to us are hardly more than they were six years ago. This is a perfect example of social advance through selling. It is also sound economics. The two go hand-in-hand.

Then there is the mechanical refrigerator. I sometimes marvel at the vision and courage of the electrical refrigerator manufacturers that caused them at the very beginning of the depression to start out on a tremendous drive to bring that new device into the homes of millions of people. Yet their expansion, their improvement of their product, the new devices that they brought out, and the new uses that developed for refrigeration have brought about a situation where, in the United States, about two million electric refrigerators went, during 1936, into the homes of the public. There has been no time in the last six years when the sale of this product has not exceeded its sale during the preceding year. But ten years ago there was no such thing as a really practical commercial electrical refrigerator. That which existed cost $400 and $500 per unit. Today the average price is less than $200.

In the Philadelphia area alone there were added to our lines last year something more than 63,000 electric refrigerators, having a value of about $11,000,000. This is a volume of trade which was created as the product of courageous selling in a depression time. To the merchants, dealers and others interested in that device in our territory, it brought $11,000,000 last year and you can't laugh off $11,000,000 worth of anything.

What have been other improvements in connection with the refrigerator? Marked betterment in standards of living. In 1920, had there been a good electric refrigerator, it would have cost approximately $63 a year for electricity to use it. This year an infinitely better box will cost about $12 or $14 a year in electric current for its use. What does that mean? It means simply that, in 1937, the residential users of electricity in our territory will use more electricity by two times for electric refrigeration alone than was used for all domestic purposes in 1920. Is that an advance in the standard of living coincident with the advanced production of new products, new processes, new uses and lower costs?

I must again apologize for taking my examples so much from my own business, but that is the business I know. It is one that definitely, without fear of successful contradiction, demonstrates that social improvement must depend upon sound economics, or that sound economics and greater humanitarianism go hand-in-hand and that salesmen can be proud of their contributions to both better economic conditions and social progress. I want to show you that these greatly to be desired objectives cannot be obtained by legislation, dictatorships or political edicts, but can result from effective and courageous selective salesmanship.

Leaving these examples for something that may be of more interest to you, let us talk, without trespassing on a good friend who follows me on this program, about air-conditioning. Air-conditioning was something practically unknown, except in a few industries where it was essential, as short a time ago as five or six years. My hat is off to that small band of indomitable manufacturers who found themselves at the beginning of the depression with a partially developed idea and no market. The necessity for developing that market began practically with the start of the depression. What has happened with respect to this new industry in our territory alone? Simply this: Today the Philadelphia Electric Company receives about one-half million dollars a year revenue from the use of electricity for air-conditioning. Over half of that load has been added since 1932.

What does that mean? In the first place, we know of no instance, and we have examined many of them in our territory, where an air-conditioned place is not a better place in which to work, to live or to play. We know of no instance where an air-conditioned establishment has not reported that its employees have enjoyed better health, have performed better work, and have lost less time through absence due to physical ailments. It has contributed to the betterment of humanity; yet, it has brought its business profits too. Expansion! New uses! New products! New processes! Better living!

In closing, if further illustrations are needed to demonstrate the truth of my text or texts, there are a few interesting facts that I happen to be personally familiar with in connection with some of our local industries. Philadelphia is a tremendous oil refining center. Its refineries are of great value and they have believed in expanded production and in new processes. Today, less taxes, the price of gasoline is lower than it was before the depression. Does not that mean improved standards of living?

We have in our territory a lot of cigar manufacturing establishments. When the depression was at the worst, one of them decided that Philadelphia needed a good nickel cigar and started out to make and sell it. It was at a time when reduction in prices seemed foolish. Today production on that cigar has reached and probably passed 10,000,000 per week, and that is not theory.

Philadelphia is the home of streamlined, stainless steel trains. Whoever would have thought that business men would have had the courage at any time in the last four or five years to build something so big as a train? Yet new processes, new materials, new welding methods and a high order of selective selling in a restricted market have brought comfort and higher standards

of living to travelers and to train crews alike.

Then there is the radio industry, which, no longer perhaps entirely dependent upon selective selling, nevertheless in its early days was a perfect example of that method of distribution. 92 per cent of all customers of the Philadelphia Electric Company have radios. Among them are the unemployed as well as the employed, the well-to-do and the less fortunate, the old and the young. Mass production, new processes, gave us better radios at lower prices. It might interest you to know that today the public of Philadelphia is using more kilowatt-hours of electricity for radios in a year than the entire annual use of residential electricity in 1920. Progress? I think so.

And then there is cellophane. There are airplanes. My time is up. I cannot go any farther. I wish I could. To me this subject is the most intensely important thing that any business-man has to consider today. True, we haven't ended yet all social and economic ills, among them unemployment, for example. It would take too long to more than mention that phase, but I know this: I know that industries are employing more people than they did three or four years ago. I know that while we have a greater velocity and volume of internal trade in the United States, we have not yet started on any greatly increased velocity or volume of world trade. I feel very sure that the path that I have been describing, if followed, leads more quickly to an alleviation of the unemployment problem than some other method that has its fundamental basis in redistribution of wealth. I believe the salesman has been an essential factor in proving that good economics begets better social standards.

Gentlemen, business men, next to their families, think most of their businesses. No business can be a success unless it serves mankind; and to me, it is an ever-recurring source of happiness that while the business that I am in must make a profit, it, nevertheless, through expanded products, courage, confidence, new processes, new uses, new production, brings continually and increasingly to humanity in our area a service that makes and will continue to make life more worth living. Yours are the same kinds of businesses and you and your salesmen can be proud of your contributions to economic and social welfare.

SALES—ELECTRIC REFRIGERATORS

(Household Models Only)

MONTH OF AUGUST AND FIRST EIGHT MONTHS OF 1937-1936

	Month of August 1937	Month of August 1936	Month of July 1937	First Eight Months 1937	First Eight Months 1936
Total United States	120,543	106,975	192,906	2,019,199	1,753,632
Maine	643	285	749	7,783	6,907
New Hampshire	417	80	621	6,076	5,703
Vermont	283	216	461	5,124	4,360
Massachusetts	6,048	4,514	7,278	80,526	67,731
Rhode Island	721	745	1,006	10,660	8,753
Connecticut	2,048	1,851	2,711	35,966	30,263
Total New England	10,160	7,691	12,826	146,135	123,717
New York	23,412	18,431	23,919	229,227	192,661
New Jersey	4,609	4,623	8,345	79,599	73,136
Pennsylvania	11,309	8,768	19,330	197,690	159,975
Total Middle Atlantic	39,330	31,822	51,594	506,516	425,772
Ohio	7,691	6,242	12,853	147,061	115,143
Indiana	3,050	2,500	5,522	57,948	50,446
Illinois	7,269	5,226	13,112	157,773	131,566
Michigan	6,547	5,355	12,232	108,816	86,599
Wisconsin	2,491	1,497	4,636	43,518	30,180
Total East No. Central	27,048	20,820	48,355	515,116	413,934
Minnesota	1,314	1,129	2,812	34,477	24,860
Iowa	663	711	2,321	30,593	27,698
Missouri	2,485	3,147	4,792	58,862	56,269
North Dakota	108	54	244	3,441	2,859
South Dakota	155	133	398	4,293	4,816
Nebraska	495	544	1,266	14,723	15,982
Kansas	767	563	1,703	23,072	21,003
Total West No. Central	5,987	6,281	13,536	169,461	153,487
Delaware	334	271	405	4,409	3,532
Maryland	1,867	1,290	2,858	25,127	19,171
District of Columbia	1,501	744	1,871	15,775	16,635
Virginia	1,258	1,662	2,833	31,364	27,942
West Virginia	848	247	1,702	24,874	22,974
North Carolina	795	1,400	2,790	43,076	34,711
South Carolina	700	1,180	1,584	20,853	16,888
Georgia	912	864	2,980	35,782	30,120
Florida	2,390	2,799	3,437	23,581	21,286
Total South Atlantic	10,605	10,457	20,460	224,841	193,259
Kentucky	1,026	1,522	2,057	26,884	24,410
Tennessee	1,455	1,162	2,056	32,566	26,952
Alabama	790	858	1,956	22,262	20,065
Mississippi	561	1,047	1,154	11,192	10,299
Total East So. Central	3,832	4,589	7,223	92,904	81,726
Arkansas	451	333	592	11,575	10,573
Louisiana	1,264	355	2,311	20,632	17,524
Oklahoma	1,255	542	1,792	20,784	18,037
Texas	5,905	4,642	7,988	80,930	72,709
Total West So. Central	8,875	5,872	12,683	133,921	118,843
Montana	281	477	1,142	8,030	8,448
Idaho	433	96	1,095	8,369	8,681
Wyoming	110	48	347	2,877	2,782
Colorado	680	609	1,495	13,555	12,940
New Mexico	165	140	442	4,254	3,532
Arizona	346	123	486	6,647	5,644
Utah	959	300	1,474	11,184	10,648
Nevada	100	211	74	2,352	2,485
Total Mountain	3,074	2,004	6,555	57,268	55,160
Washington	2,392	2,140	4,084	30,124	29,645
Oregon	1,041	1,048	1,843	15,604	18,862
California	8,199	14,251	13,747	127,309	139,227
Total Pacific	11,632	17,439	19,674	173,037	187,734

Figures based on report by the NEMA on Net Sales to Dealers and Jobbers.

Relations With Public Bodies

By C. W. Kellogg
President, Edison Electric Institute

A talk before the Public Utilities Association of West Virginia, White Sulphur Springs, W. Va., Sept. 17, 1937

FROM the earliest days of the electricity utility business the subject of politics has entered the picture. The electric utility business cannot be conducted without the right to run electrical conductors either over or under the streets. This right has to be granted by the governing body of the city. In the early days it was supposed that this right, once granted, gave its possessor the ability to charge for his product what the traffic would bear and was therefore supposed to have great value. City politicians were not slow to see the possibilities of such a situation, which in some cases involved the payment of substantial sums or the capitalization of so-called "franchise value" at a large amount.

It gradually developed, however, from the experience of investors and consumers that the matter of fixing rates was a purely economic one which was best done for the interest of all concerned (the public and the utility) in an atmosphere as far removed as possible from partisan politics, and the realization of this led to the now well-nigh universal regulation by State commissioners. The same logic of experience taught that a franchise, or right to use the streets, was as much for the benefit of the people as for the benefit of the utility—that the streets should properly be used by the utility to bring electricity to the people the same as they were used by the butcher and baker to bring food to them, and that hence a franchise should have no value in and of itself.

Many states, in drafting their utility regulation acts, gave specific recognition to the principle I have stated by providing that as and after existing franchises from cities expired they should not be renewed as such but should be replaced by revokable permits from the State which would run during a period of good behavior. The formerly difficult problem of rival claimants for a given franchise was solved by providing that no company could invade the territory thus allotted by State authority to an existing company so long as the latter continued to care adequately for the service requirements of the people residing in the territory covered by its permit. These provisions prevail in many States today. Their purpose was obviously to put the industry on an economic and service basis and to eliminate the issues upon which politicians proverbially batten.

It would be perhaps expecting too much of human nature to imagine that these precautions would entirely eliminate political considerations from the utility field. The City Fathers still had several shots in their locker; there still remained local permits for street uses, taxes, the threat of municipal competition, the contract for street lighting and the like. Also many of the considerations originally limited to municipal governments were by the later plan merely transferred to the broader area of State politics and in very recent years extended still further to the policies and activities of the Federal Government.

In the early years of the utility business the pressure on the utilities to engage actively in local politics became almost irresistible. This early tendency, however, led to its own destruction, partly from painful experience when the utility backed the wrong horse (politically speaking) and partly from a gradual realization that the utilities, serving as they do *all* the people, should not stand in or try to stand in with any one party or group of all the people.

What I have said has been merely by way of background for my present discussion. I think it can now be stated as a general proposition that the electric utilities appreciate fully the futility of their interfering in any way in partisan politics. There are, however, other considerations which cannot be overlooked in public relations.

The very complexity of our Governmental set-up, whereby some measure of regulation of utilities is performed by cities, counties, states and the Federal Government, not to mention the legion of taxing bodies—all these make it necessary for the utilities to be continually appearing before public bodies to represent their interest in the questions before such bodies.

My contention is that such appearances are not "politics" in the ordinarily accepted meaning of that word. They rest not on pull or favoritism with any clique or party, but upon facts properly marshalled and effectively presented. They form the proper time and place for the utility to meet formally with the representatives of the people they serve to discuss in open forum the pros and cons of each important issue that arises with respect to utility service, whether in the city, state or nation. In our present day set-up they represent golden opportunities for the highest responsible operating officials to impress their character and personality upon the people they are organized to serve.

Many executives in the past have made the mistake of delegating to subordinates the job of appearing before public bodies. It is a mistake in several ways. In the first place, the relations of any public utility with the people it serves or with their representatives is the most fundamentally important matter affecting the welfare of the utility, and as such deserves the personal attention of the highest ranking officer available. Second, the members of any public body having authority over a utility company, for the very reason of that authority are entitled, and therefore react more favorably to, the presentation of the company's position by the ranking executive in the territory affected. In the third place, with the size and complexity of most modern utility companies, the chief executives cannot, in the ordinary conduct of the business, make personal contact with more than a tiny fraction of their customers; while in an appearance before a public body they can make this essential personal contact, the exercise of which, if they are thoroughly up to their job, should be the most important function they have to perform.

In most communities the electric light

and power company is one of the largest enterprises in the city. It is to be expected that the man in charge of such an enterprise should be of a breadth and force commensurate with the enterprise he heads. If any public body has jurisdiction over such an enterprise it is only logical that it should expect to hear about its affairs from the recognized head of the company.

All of us should keep in mind with respect to public bodies that we are serving the public, not they us, and that it is right and proper that from time to time at the appropriate place we should be called upon to render an account of our stewardship. We should remember also that such appearances before public bodies are the one and only substitute for the sort of political pressure and political trading that has been found from the experience of the past to be such a baneful influence on the whole utility situation.

Another point to have in mind in favor of the public discussion and presentation of a utility's position before a public body, as compared with a settlement resulting from political maneuvering, is that the latter is likely to be a patched up affair, merely leading to some other trade when the politicians can develop some new situation. The settlement after a full public presentation is much more likely to rest on the solid ground of fact and therefore to be more sound and permanent; it is less likely to contain the germs of a subsequent political raid.

Think over the utility companies with which you are familiar and I know you will find that the most successfully operated ones are those where the principle I have stated is followed—where the high-ranking officers of the company make the presentation of their company's case before public bodies their personal concern and responsibility.

A common mistake by utility companies is to send a lawyer to attend public hearings where the matter in controversy or for consideration is not a legal one but a question of presenting facts. This is sometimes done in the belief that the lawyer may make a better speech than the operating official would do. Lawyers are required for court cases and in any case where testimony is to be taken, but in all other cases the direct statement of the ranking executive carries a conviction which more than offsets any lack of eloquence. With many a public official the lack of eloquence will form a bond of union with the speaker.

My remarks about appearances before public bodies are not mere swivel-chair soliloquies but are based on many years' personal experience with city councils, State and Federal commissions and committees of State legislatures and Congress. I have found in the overwhelming majority of cases that public officials were eager to get and willing to learn from facts frankly and fully presented to them. Eloquence and table-pounding are equally unnecessary but clarity is most desirable. If the responsible executive of a company has not a clear idea of the situation he is presenting, he can hardly expect to convey a clear picture to someone else; but if his own thoughts are clear he should be able to paint a correspondingly definite picture for his hearer.

It is often easy for us, when we feel we know our own business and our own problems so well, to forget that the other fellow may know little or nothing about them. We must also remember at all times that our public official is representing our customers and that therefore his chief concern is how our problems affect the consuming public rather than specifically how they may affect us. It is our job, therefore, to translate our problems or conditions into their effect on the public, always keeping in mind that while to ourselves our problems cover the whole horizon, to the public they are only a small segment of what they have to buy.

It is natural that many executives from desiring to avoid any taint of political activity in the handling of their properties, should have come to lean backwards to the extent of avoiding contacts with public bodies. If such there are, the distinction between the two forms of activity should be plain. The latter is indeed the very way to avoid the former and is the way our country has chosen to avoid it. Such contacts should be welcomed as opportunities rather than avoided as an irksome task.

One of the basic problems confronting the country and arising from the growth in individual size of our industries is how the leaders in great industries like the utilities can make effective their own character and personality in dealing with the public and with their customers. The criticism of mere bigness in our modern corporations, which has been voiced from time to time on the floor of Congress, is but the reflection of the impression of aloofness that is felt to exist between business leaders and the people, both individually and as represented by their government. Appearances before public bodies are one of the most effective ways to remove this impression and should be utilized and appreciated for that reason if for no other. Leadership is a personal matter and the opportunity to exercise it carries also the public obligation to do so.

I cannot close my remarks on the subject of appearances before public bodies without referring to a feature of our business which I have always felt to be one of its very foundation stones, namely the daily and hourly contact of the members of our organizations with the people they serve. I should be entirely misunderstood if I gave the impression that, because the highest available executive should step out to represent his company before public bodies, this relieved the other members of the organization of their responsibility with respect to the standing of their company with the public.

The exact reverse is true; and to my mind this is what makes the utility business such a fascinating one. Even the smallest utility has thousands of customers, the larger ones scores or hundreds of thousands. It is physically impossible for the executives to meet with all their customers; these contacts must be made by the other members of the organization all the way down the line. When John Smith (or Mrs. Smith), a customer, does business with the utility company, it is through Bill Jones, an employee, and so far as Smith or his wife are concerned, Bill *is* the company. For the customer, in that transaction, the whole reputation of the company rests on Bill's shoulders. That is a tremendously sobering thought but if Bill is the right sort and his company's policies and service are right, it is a challenge to that innate sense of responsibility which every worth while man feels and delights to rise to. It should add interest and luster to any job, no matter how otherwise conditioned.

In summary, my advice to executives is don't let absorption in the many interesting details of operation allow that most important matter of appearing before public bodies to be handled with anything but the greatest care and thorough preparation, and don't "let George do it." It is your supreme opportunity to display business statesmanship.

Industrial Heating Offers Ideal Opportunity for Real Selling

By W. H. Sammis
The Commonwealth & Southern Corporation

A Talk Given Sept. 22 at Schenectady, To Those Attending the General Electric Company Industrial Heating Course

INDUSTRIAL HEATING successfully and economically by electricity is not an old art. In 1910, there were only three steel melting furnaces in operation. It was not until 1918 that the melting of non-ferrous metals was introduced, and it was 1920 before metallic resistor type furnaces became reliable. Today, electric industrial heating is employed successfully, not merely in the metal industries, but in almost every industry, to reduce the cost and perfect the product. Electric heat has extended into such places so foreign from the metal industries as the citrus fruit industry for preserving of the citrus fruit by what is known as the Brogdex process and in connection with the breeding of beneficial insects for the control of pest insects in the citrus groves, into the food industry for puffing wheat and rice, into the agricultural industry for heating soil and is used for such delicate operations as branding fragile textiles and cellophane.

The growth of the industrial heating load has been almost phenomenal. Based upon certain figures I have obtained, I would guess that over five million kilowatts of industrial heating equipment has been sold by the various manufacturers. There are no figures of the amount of industrial heating load served by the utilities in total, but figures from a few utilities will give you some idea of what this load means to the industry:

Consumers Power Company	48,000 kw of industrial heating load
Boston Edison Company	34,000 kw of industrial heating load
Union Electric Company of Missouri (St. Louis)	75,000 kw of industrial heating load
Detroit Edison Company	67,000 kw of industrial heating load
Commonwealth Edison Company	75,000 kw of industrial heating load
The Tennessee Electric Power Company	27,000 kw of industrial heating load
Milwaukee Electric Ry. & Lt. Company	75,000 kw of industrial heating load
Philadelphia Electric Company	38,000 kw of industrial heating load
Niagara Hudson Power Corp. system (exclusive of Niagara Falls Power Co. and Canadian Niagara Power Co.)	78,000 kw of industrial heating load

In addition, industrial heating loads lend themselves frequently to off-peak operation and the resistor type heating load has a one-hundred per cent power factor.

In reading the program for this conference, I noticed the title, "Industrial-Heating Course for Power Sales Engineers of Electric Service Companies." I question whether Power Sales Engineers realize the confidence the utilities place in them. According to the Edison Electric Institute's statistics for the year 1936, large commercial light and power sales were approximately $585,000,000 or 28 per cent of the total revenue from ultimate consumers of the entire electric light and power industry, not to mention small commercial light and power sales which were about an equal amount. This amount of business deserves and requires very close attention, particularly when we realize it is largely competitive, and to be entrusted with the responsibility for its continuance and growth is a compliment to you gentlemen.

Sometimes I wonder if the term "Power *Sales* Engineer" is really descriptive of what should be the duties of such an individual. The dictionary terms a salesman as "A man who sells goods." In our industry, of course, we depend on selling our goods, or, as I prefer to use, "service" for our existence. I use the word "service" in the dictionary's interpretation, "To be efficient and effective for a purpose." To illustrate, on a recent inspection trip through one of our properties, our president asked a so-called Power Sales Engineer in one of the cities what he did. The man replied that he called on the large commercial and power customers periodically, chatting with them about things in general, perhaps today about the strike situation and the next time about a contemplated fishing trip, etc. The next city we reached our president again asked another power salesman about his duties. This fellow explained to us at length the service he gave to the power customers, in assisting them with their wiring problems, their motor problems, their transformer problems, their processes requiring heat, and in fact one could not help gaining the impression that this fellow was the electrical engineer for most of the power customers in that territory. We were convinced that he was performing a real service for the company by being of service to the customer in the utilization of the electricity which the customer bought. Such an individual could not help but have the confidence and goodwill of the customers under such conditions, and as the saying goes, "A man is judged by the company he keeps," just so, a company is judged by its representatives. I am afraid too often the Power Sales Engineer makes his visit a social call rather than a service call. Perhaps every customer does not have an engineering problem baffling him at the time of the representative's call, but the representative can, with a little advance preparation, have something to bring to the customer's attention at the time of his visit. Sales aids are constantly being developed, such as the sight-meter, small industrial heating units, articles clipped from magazines having to do with the particular customer's type of business, publications, such as General Electric's Electric Heat in Industry, individual company publications giving data on specific industrial heating applications, *Timely Ideas* published by McGraw-Hill, and a new publication (*Electrified Industry*) being produced by Mr. J. B.

Martin, formerly of *Electric Light & Power*.

It is commonly conceded in the industry that much of the power business that is lost to isolated plants is the result of misunderstanding between the customer and the company. If we are directly of service to our customers, we minimize the threat of such occurrences.

I have stressed service and the retention of existing business in the past few remarks, but nevertheless I am not unmindful of the fact that a Power Sales Engineer's job is also to sell additional kilowatt hours. The industrial heating field offers an ideal opportunity to do some real selling. In addition to knowing the subject, a good salesman must be enthusiastic about the product he sells and it is surprising how contagious such a characteristic becomes. I recall a typical experience. A customer in one of our towns desired heat for an enameling application. It happened that we sold both gas and electricity in this town. Both the Industrial Gas Engineer and the Power Sales Engineer were anxious to obtain the load. Each man made up his figures and tabulated the advantages for his particular product and submitted them to the utility manager before submitting them to the customer. The manager became convinced that it was to the customer's advantage to use gas in this particular instance. The Gas Industrial Engineer advised the customer that, as a utility selling both gas and electricity, we felt he should buy gas equipment for this job and explained the economies in great detail. After working on the job for some time the Industrial Gas Engineer reported to the manager that he was afraid the job was going to oil. There had been considerable rivalry between the gas and electric man in this particular property so the electric man was just chafing at the bit for an opportunity to contact the customer. He was finally given permission to see the customer. This fellow was just so chockfull of enthusiasm as to what electric heat could do that to everyone's surprise he sold an electric job without much ado about figures, and the job stayed sold.

In selling, the utility man should take full advantage of the equipment manufacturer's representative. Generally, he is more conversant with the economies and advantages of his equipment and only welcomes the chance to sell the advantage of electric heat so that he may have a chance at the equipment sale. It has been my experience that the manufacturer's representatives have been most helpful indeed.

"I tell you I won't have gas! I'm a director of the electric light company."—Answers.

While on the subject of selling, I might tell you of the progress of the proposed National Power Sales Publicity program. Many of you know that such a program has been discussed by Power Sales Engineers for several years, but it was not until The Petroleum Electric Power Club in the Southwest employed such a plan in the sale of electricity for pipe line pumping that the matter was given serious attention. Incidentally, this is the third year for their program. Last spring in Chicago, following the E.E.I. Sales Conference, a National Power Sales Publicity Committee was appointed, consisting of about twenty-five of those present at the meeting representing utilities from all sections of the country. This Committee endeavored to interest the utilities throughout the country in a program calling the attention of the executives of industries, through national advertising mediums, to the advantages of purchased power—that it is economical, flexible, etc. To determine the utilities' desire to participate in the program a conditional contract was sent to each utility. This contract contained certain limitations:

(1) That it would not be effective unless 60 per cent of the utility industry signed up.

(2) That although a three-year program is contemplated, a utility can decide to drop out after the first year if it desires.

and (3) That the utility may have representation if it desires in the administration of the program.

To date, companies representing about 5,000,000 meters of the industry have signed up. If you are in favor of such a movement and your company has not indicated its desire to participate, here is an opportunity for you to help the cause.

In conclusion, gentlemen, the General Electric Company have done a real service for the utility industry by arranging this Conference. In my opinion the applications for the use of electric heat in industry are almost unlimited and the possibilities for load growth enormous. The companies of the Commonwealth & Southern group are actively promoting this load and I am glad to say several of their representatives are in attendance at this conference.

Prize Awards Offered for 1938

(*Continued from page* 403)

upon request, be returned to contestants after the awards have been announced at the 1938 Convention of the Institute. Prize winning papers will be available for inspection at the general offices of the Institute.

The CHARLES A. COFFIN AWARD will be awarded to the public utility operating company within the United States which, during the year 1937, has made a distinguished contribution to the development of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company awarded the medal will also receive $1,000 for its employes' benefit or similar fund.

The THOMAS W. MARTIN AWARD consists of a bronze plaque donated by Mr. Thomas W. Martin, President, Alabama Power Company, to the public utility operating company within the United States which, during the year 1937, has shown the greatest contribution to the advancement of Rural Electrification—Agricultural advancement within the company's territory due to uses of electricity, development of rural load, cooperation with other agencies, extension of rural lines, organization and plan for conducting rural electric development.

The Curtis and Hughes Awards are discussed in another article elsewhere in this issue.

Don't Give The Goose The Ax

By C. E. Greenwood
Commercial Director, Edison Electric Institute

THE tales of Shanghai and the taint of Kluxism in the High Court have headline importance. But such agitations, attention compelling as they are, are temporary. The annual internal skirmish on business budgets goes on forever. Just now expense budgets are headliners for attention in most utility companies and rumor has it that some serious sniping is contemplated in sales and promotional items.

There can be no more important consideration for the utility than the one that governs the in-take of dollars. Even at a value of fifty-nine cents, it is all we have to pay dividends—if any—to the holders of our securities. If anyone wants to make a company hoist the white flag and capitulate, the best strategy is to stifle the supply of kilowatt hours and revenue by closing the lanes to further profitable new business. Please note the word "profitable." Determination of profitable business of certain classes is a tough nut to crack without knowledge of the cost of serving.

Now it is a fair assumption that if the Advertising Dollar is not producing a fair return on the investment, there is something wrong with the method of spending it, or the amount should be allocated against building up a different class of service. Why strike the entire amount from the budget?

Read the present advertising plans of all great industries. They are equal or larger for 1938. Even the film industry is increasing advertising for selling entertainment. Paramount, for one example, ups their appropriation 25 to 30 per cent. One will note re-allocation of advertising items in many industrial budgets, changes from national magazine advertising to newspapers, radio, or other media—or vice versa. But if one noted a slash in the total sales and promotional budget for the ensuing year, a question would pop in mind if this was not the time to sell your stock, providing, of course, that the present market ski downward had not already influenced unloading.

Those acquainted with the operating technique of the electric utility industry would not be so radically inclined. They might query, WHAT'S THE IDEA? The answer may be, "A matter of necessity and mercy"—"necessity" resulting from the misgivings of investors as to the future value of our securities which dam the supply of new capital for expansion; or "mercy" on the production or generating department. The tempo of selling in recent years has given those responsible for the source of supply much to think about. There never was a time when the minds of engineers, and those responsible for the marketing of electric service, were thinking so nearly down the same alley.

Now results obtained from the Advertising Dollar are more easily measured than computation from the long deferred return of the elusive Promotional Dollar. But the very character of our utility business makes it obligatory to pioneer and develop new classes of service, and to keep pace with the market requirements for reliable electric products which research, and gradual perfection for commercial use, have made serviceable for homes, commerce and industry. Such dollars expended may not yield returns for five to six years. Yet, if of proven value to the consumer, and of potential value as a profitable revenue producer, shall that service be relegated to the list of ineligibles?

It is this same Promotional Dollar which business building demands, that usually puts the commercial department in the red and makes higher executives see the same color. Result: the sales and promotional budget is cut which is the equivalent of cutting off the arm of a pugilist so that his weight may meet the expected weight for a fistic encounter.

PREFERENTIAL MARKETING is a way out during present limitations. For example, if distribution lines in one section are well loaded with highly valuable but with low load factor air conditioning service, shall the air conditioning promotion money be "washed up," or will the amount be allocated against the promotion account of the pantry and counter variety of commercial cooking devices, a high load factor service with devices working long hours most months of the year.

And how about electric water heating service? A local situation may be unfortunately so severe that promotional pressure on electric cooking must be temporarily released. Then how many present range customers use other fuel for heating water? Here is a class that can use off-peak water heating service with no added capacity. The company needs the business. Water heating service needs the advertising and promotional money.

Again, PREFERENTIAL MARKETING will help solve the profit problem among "minimum bill" and low-use customers. The electric refrigerator turns the trick among certain low income groups, but radio, roasters, and toasters make profitable contributions toward boosting that group of users of thirty kilowatt-hours monthly and under. The living conditions of some of this class naturally result in low-use, but with others, buying power of equipment is limited and the smaller appliances should be promoted.

Complete knowledge of the local market coupled with selected points of attack, should justify an adequate supply of Advertising and Promotional dollars to do the selling job. It needs both eternal and internal selling on the part of commercial executives to keep the supply of new business at normal pressure. Experience has proven conclusively that dollars needed to pick up business that has been allowed to go by default increases in inverse ratio to the cut in appropriation. Slice the dollar for promotion of a service in the development stage in half, and it will need four times the amount to pick it up again.

Granting this is fact, it may be wise procedure to curtail in certain budget emergencies. Therefore is it not all-important that any practice to that end should be carried through in such a way that it cannot be construed by consumers enjoying the particular service curtailed, that the company has lost faith in it, and committed an error of judgment in selling it.

Now there are other market considerations demanding attention of commercial men along with lowering "nets" and budget cuts. He will observe the increasing efficiency of apparatus produced by manufacturers of quality products. Let

us consider just two of them, both in the major load-builder classes. Although many of the ranges of older types produce an average energy of approximately 1500 kilowatt-hours annually, the new ranges with improved insulation and automatic control will produce around 1250 kilowatt-hours from the average family, and in low income families in certain sections of the country nearer 1000 kilowatt-hours. The new type electric refrigerators are operating on a national average of approximately 450 kilowatt-hours and less instead of around 600 for older style boxes.

Carrying our observations a step further, what is the trend of replacements? It is a fair guess that in range output it was at least 10 per cent in 1936. In the case of refrigerators the percentage of replacement to total sales is estimated at from 10 to 15 per cent. There will be increases in these percentages as wear and tear and obsolescence register their influence on the buying public. This progress favors the buying public, and has its indirect advantage to the company in enabling it to sell a better cooking and a better food protection service at lower cost.

Such observations may not sound cheerful to those responsible for increasing the residence energy output. But they are pointed out as a challenge to commercial men, and to emphasize their obligation to consider this march of progress in operating efficiency when planning for the net kilowatt-hour increase per residence for 1938. Sales quotas should be raised accordingly, and the boss of the Budget should be made fully conversant with your problems.

One other reason to "hold everything" in that Sales and Promotional budget. There can be no doubt that with proper support, new peaks in energy sales will be recorded. The electrical industry was never better organized to go forward with record sales accomplishments. The history of American industry has shown that the synchronization of local sales activity into a mass coordinated effort is never failing in profitable results, if properly organized and planned. This truism was sensed by the utilities years ago and its mobilization with manufacturers, wholesalers, contractors and dealers for educational and sales achievement has continued in power and effectiveness. National promotional programs form the background of educational and sales activity. Methods of distribution of electrical products have changed as the utility has gradually given up direct selling of those products having a fair public acceptance.

Today it is estimated that a maximum of 12 to 15 per cent of the total volume of electric household appliances is sold by the utilities, although they carry the major portion of the burden of promotion. We are in the Dealer Era where upon each utility is placed the obligation of enlisting an intelligent, active dealer sales stimulation and support. It is an expense which one will hope will diminish as more dealers in a community become self-sufficient in creative selling.

One disadvantage has been the attitude of many dealers. The average dealer selling a household device appears to think more about the revenue it may bring to the utility than he does about the service it gives to the buyer. Unfortunately for all, there are hundreds of retail outlets that join in this chorus without reasoning that "use" is the one possibility of revenue to the utility, and many thousands of appliances they sell do not get normal use. Many thousands of dollars must be spent in publicity and advertising on household services and making people WANT TO BUY. It is the customer who is sold on the service, and goes to the department store or other dealer to BUY the electrical product to give that service, that is the best revenue producer for the utility company.

As we press forward in commanding consumer interest and moulding public opinion of our service, we will expect consumers to BUY more kilowatt-hours because they have been made to WANT them. One should not lose sight of the fact that it is the utility's job to humanize the kilowatt-hour and translate the term into something our customers understand. We are now selling Light for Seeing and for Conserving Eyesight and Promoting Health; Electric Cold for the Protection of Food in Home and Store, and that special Adequate Refrigeration Service that an electric refrigerator can give; we sell Modern Kitchen Styling with electric equipment, which not only establishes a new standard in home building which compares with present-day bathroom standards, but Modernizing by Electrifying gives new value to outmoded real estate, a fact recognized by builders and bankers; and we sell a social service in Better Living in the rural home through installation of Running Water made possible by an electric water system. We are translating kilowatt-hours into the service it renders. What an apt method of making comparison in values! But again how heavily this educational process draws on the sales and promotional budget.

In an address by Mr. Floyd Carlisle before the Electrical League Luncheon recently held in New York City, and which appears on other pages of this issue of the BULLETIN, Mr. Carlisle advised commercial men to "work harder and sell more goods." This will get our minds off many other troubles. Advertising must lock arms with selling to reach that objective.

And PREFERENTIAL MARKETING will guide promotional activity into channels which produce greatest volume of useful electric services. May the budgets be liberal to enable the selling forces to reach still higher goals.

West Virginia Association Convention

J. K. BUCHANAN was elected president of the Public Utilities Association of West Virginia at the 19th annual meeting of the association, held at White Sulphur Springs, Sept. 17-18. Other officers elected were C. van den Berg, Jr., and R. Paul Smith, vice-presidents; G. B. Moir, treasurer, and A. Bliss McCrum, secretary.

E. B. Smith of Fairmont made an address on the importance of developing some of the hidden resources of West Virginia. He advocated the active cooperation of public utilities in building up the cash income of the communities served. Alexander M. Mahood, president of the National Association of Railroad and Utilities Commissioners, read a carefully prepared paper showing the attitude of the national organization on some of the problems confronting regulatory authorities.

President Kellogg of the E.E.I. spoke on "Relations With Public Bodies." His address is published in this issue of the BULLETIN.

TVA Suit Postponed to Nov. 15

Hearing of the suit of Tennessee Electric Power Company and 16 other utility companies challenging the constitutionality of the TVA, originally scheduled for October 18, has been postponed until November 15. The suit will be heard at Chattanooga before a three-judge Federal Court composed of Circuit Judge Florence E. Allen, Cleveland, District Judge John D. Martin, Memphis, and Judge John D. Gore of Nashville.

Trouble Analysis and Power System Economics

By W. B. Elmer
The Boston Edison Company

A paper presented before the Transmission and Distribution Committee, E.E.I., Chicago, Ill., May, 1937.

WHILE it is true that most machines owe their improvements to the study of their faults, this process has not yet been applied with full effectiveness to electric power systems from the economic standpoint.

In the first place, any power system, while being in a sense a single big machine constructed to generate and distribute electricity to numerous customers, is nevertheless so extensive and complex and subject to such ramified jurisdiction that it is an exceedingly difficult problem to establish a state of uniform economic adjustment throughout the whole range from energy source to watthourmeter. This state is all the more difficult to attain since operating costs properly include what is generally considered to be an intangible item, the loss of customer good will resulting from service interruption and other service irregularities.

Secondly, the engineering problems of electric distribution have in the past been somewhat neglected in favor of the more challenging problems of electric generation and transmission. During recent years, however, attention has been focused strongly upon the distribution system, due to the growing realization that the largest item in the cost of electricity is the distribution cost, and that very small refinements of design are profitable due to the volume use of distribution equipment. The earlier efforts of the distribution engineer were devoted to building a dependable system, without adequate knowledge of economic relationships. A good degree of reliability having been achieved, the economic aspect is now under strong scrutiny.[1, 2, 3]

In particular, economic studies of overhead distribution system design are doubly profitable, since the results of such studies can be applied not only to new plant, but to existing plant, through the fact that overhead systems are rebuilt at periodic intervals by replacement of decayed carrying poles. At the time of pole replacement, pole top construction can be completely modernized at slight additional cast. Due to growth, shifting, replacements, and other factors, the average age of the typical overhead system is probably somewhat less than half the average life of the carrying poles used.

If an electrical system is to be designed and operated with a maximum degree of economy, actual operating costs of the various designs must be based on operating records rather than on estimated percentage values. By keeping detailed trouble and outage records, these costs are made readily available.

In one noteworthy attempt to infuse economics into system design on the basis of trouble records, "service standards" were established individually for each division of the electrical system, such as the generating, transmission, bulk power station and primary and secondary distribution.[1] While this method had the merit that it avoided expenditures which were relatively inconsistent with overall existing service reliability, of each division of the system, the fundamental problem of correctly determining the absolute rates of trouble and outage toward which to work was still unsolved. It was possible under this method for some elements of an electrical system to operate with reliability which was economically excessive, while others continued to produce excessive outage.

In the procedure here recommended, trouble and outage rates are carefully established from operating experience, losses due to outage are expressed in their monetary equivalents and both factors are included in economic studies of operating and design problems.

The type of trouble record described and suggested is called the "System Trouble Analysis" and is the outgrowth of cooperative studies made by several large companies. Many of the details of procedure given herein for establishing this analysis are those of The Boston Edison Company.

For definitions of some terms subsequently used, see the glossary, Appendix A to this paper.

Obtaining Reports of Troubles

It is important in maintaining a useful trouble record to establish channels for obtaining complete, accurate reports of troubles promptly following their occurrence.

Troubles fall naturally into two main divisions in point of seriousness; those that cause service outage and those that do not.

Some of the larger operating companies supervise distribution system troubles from central despatching offices, which render daily reports listing all troubles which have occurred over the preceding twenty-four hour period. Such reports usually include all troubles which have caused customer outage plus most of the more serious troubles which have not. The amount of service affected and duration of each outage are usually given.

Many minor troubles occur on distribution systems which are not sufficiently serious to warrant inclusion in a despatcher's daily report, yet require immediate attention. These are customarily attended to by a troubleman who makes a report of each on report sheets provided for the purpose. Where this practice is followed, these reports form a valuable adjunct to the despatcher's daily report.

In addition to the aforementioned troubles there are numerous minor defects which are repaired by line crews in the course of their daily work. Usually no comprehensive record of this class of troubles is kept. To establish such a record would necessitate the setting up of a special reporting procedure which would require considerable supervision to establish and enforce. The occasional discovery, however, of some easily correctible weakness of long standing usually suggests that even these minor troubles ought to be systematically recorded.

Because of the difficulty in securing adequate and consistent reports of the minor troubles, it is the practice of some

[1, 2, 3] For numbered references, see list at end of paper.

companies to include in system trouble statistics only those troubles which cause outage, although complete operating costs are not afforded by such records.

Individual Fault Analysis and Report

The next essential stop in building up a system trouble analysis is the assignment of the fundamental cause of each trouble.

The causes of many troubles are evident from the original reports, as for instance, in cases of poles struck by vehicles, duct lines unearthed by contractors, and wires accidentally short-circuited by linemen. Many other troubles, however, need further explanation and a few require a detailed analytical study to determine the true cause.

Fault analysis work requires the services of investigators who are trained in a highly developed and specialized technique. In addition to regular daytime analysis work at central quarters or in the field, these investigators should also be available at night with cars and full equipment for field analysis work.

Whenever possible, faults and detective equipment are sent in to the central fault dissecting quarters where the analyses are conducted. Troublemen and repair crews are trained to preserve all evidence which remains after a failure without disturbing it in any way when it is of such a nature that it can be removed to the dissecting quarters.

A report of each fault analysis, in which is given a complete description of the conditions as found, all facts which developed during the analysis and finally, the ascribed cause of failure, if determined, is written and placed on record.

In many cases the cause of trouble can be almost, but not quite definitely proved. In these cases it is considered unwise to negate the result of a skillful analysis which strongly indicates a specific cause by classifying the trouble as unknown, on a small risk that the indicated cause is in error. In other instances, sufficient facts cannot be assembled to disclose the cause with reasonable certainty and it must be recorded as unknown.

Classification and Tabulation of Troubles and Outage

Causes having been assigned in each case where possible, trouble data are then classified and tabulated at regular intervals of time.

In order that the record may be of the greatest general usefulness, it has been found desirable to classify and enter the troubles in the record daily. Tabulations may be made from this list in such form as may be desired from time to time.

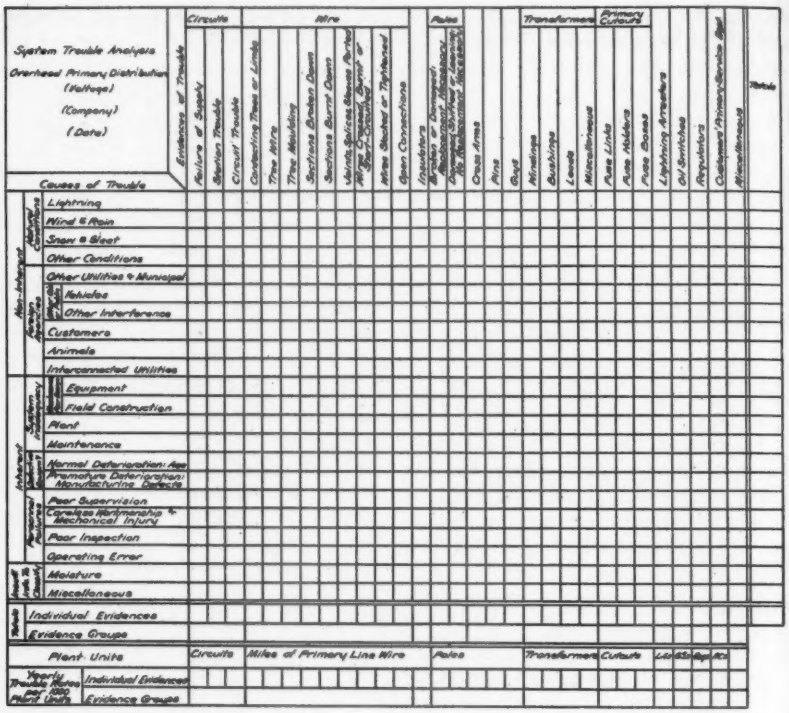

Fig. 1 — Example of System Trouble Analysis Form for Overhead Primary Distribution.

A suggested typical form for the tabulation of overhead primary distribution system trouble is shown in Fig. 1. (See Appendix A to this paper for definitions of headings.) In this table, trouble and outage are entered vertically by "Cause" and horizontally by "Evidence." The "Cause" classification here used is based upon a "System of Uniform Records of Electrical Operation of Power Systems[4]," originally developed for relay troubles, which has been found excellently adapted to distribution system use.

"Causes" are divided into two main groups, "non-inherent" troubles which originated from causes outside the power company's system such as natural conditions and foreign agencies, and "inherent" troubles, which originated within the system, such as defective equipment, personnel failures and system inadequacy.

Among the "Evidence" headings, each of the chief units of apparatus used on the electrical system, such as wires, poles, transformers, etc., is listed individually.

Subtotals and totals for each electrical system may be obtained from the tables by suitable addition, and trouble and outage rates may be established therefrom.

Cost of Outage

Before discussing the application of the system trouble analysis to design problems, it is necessary to consider the economic aspect of service outages.

It is acknowledged that the conclusions drawn in the following paragraphs as to the criterion for measuring and evaluating outage are not considered to be definitely proved nor even capable of proof, but are advanced as a theory which is believed to provide a better basis than that now commonly used in answering questions of system design.

The present procedure followed by most engineers in working out details of system design, is to study all promising alternative methods for accomplishing a desired purpose, and to make a final

selection which appears in the best judgment of the engineer, when based on his individual background of experience, to embody the most favorable combination of first cost, operating cost and operating characteristics[3]. In making decisions in this way, it is obviously difficult to fairly weight such factors as service dependability and regularity of supply voltage and frequency against dollar values of installation and operating costs. However great this difficulty, the decisions nevertheless must be and are made. Any method by which such guess-work can be reduced to a more systematic basis should be welcome. It is, therefore, suggested that a monetary equivalent for the unit of service outage be established and used to reduce the uncertainties of this intangible element.

Although there are several intangible factors to be considered in connection with plant design such as the importance of maintaining exact service voltage and frequency, and avoiding lamp flicker, none of the other considerations compare in importance to service reliability, and they are, therefore, dismissed tentatively from further considerations.

The cost of the system trouble includes:

1. Loss due to service outage
   a. Loss of customer good will
   b. Loss of revenue
2. Cost of locating and repairing trouble
3. Loss due to street disturbances, such as
   a. Loss of public good will
   b. Loss of property damage and personal injury.

The bulk of the trouble cost lies in the first two items, since serious street disturbances are relatively rare. The chief cost of troubles then lies in the cost of outage and the cost of location and repairs.

It may at first thought be argued that a determination of the money equivalent of such an abstract thing as service outage is unreasonably speculative and that real money would never be spent on the basis of economic studies in which such a value was applied. It should be realized, however, that each individual decision to spend money on plant includes a definite consideration of service reliability and, therefore, carries a definite implication that the unit of service outage exceeds in value a specific amount of money. It is further self-evident that any systematic attempt to determine the money equivalent of outage can involve no greater uncertainty than that implied in numerous individual past decisions in which this factor is loosely considered. Conducting a study to establish the value in question holds the advantage that the finding should represent a weighted and averaged result of many direct determinations by a variety of methods, whereas the usual day to day decisions as now made, in which reliability is a factor, must of necessity assume widely deviating values.

There are two steps in establishing the outage equivalent, one to determine the unit of measure for outage, and the second, the amount of unit loss.

In determining the outage equivalent, several methods of approach are possible; (1) analysis of the cost to the company through loss of customer good will, (2) analysis of the economic loss resulting from service outage, (3) averages of individual personal opinions based on a variety of viewpoints.

(1) Loss of good will becomes effective against the power company through:

(a) Unwillingness to adopt certain electrically-operated appliances in preference to competing devices.
(b) Rejection of electric service in favor of competitive service.
(c) Demands upon time of employes to handle complaints.

The loss of good will manifested in the above ways is probably determined largely by the following factors:

(a) Amount of load affected:
   1. Time of day of interruption.
(b) Duration of interruption.
(c) Nature of use.
(d) Regional location.
(e) State of business conditions.
(f) Prior customer service experience.
(g) Customer disposition.

Although the outage loss is manifested directly to the company only through loss of good will (and relatively insignificant loss of revenue), the above factors are too erratic and intangible to offer hope of any solution to the problem.

(2) Economic losses resulting from service outage are:

(a) Loss of industrial production.
(b) Destruction of factory equipment, stocks, or materials.
(c) Business delays.
(d) Loss of human comfort.
(e) Accidents due to failure of lights in homes, hospitals, etc.

These economic losses are determined from the same factors cited under (1), minus the last two, as follows:

(a) Amount of load affected:
   1. Time of day of interruption.
(b) Duration of interruption.
(c) Nature of use.
(d) Regional location.
(e) State of business conditions.

These factors offer a much better avenue of attack. Although from the viewpoint of its own immediate welfare, the company is interested only in the loss of good will resulting from service outage, these good will losses are the direct consequences of the economic losses suffered by the customers. In theory, the customers should, perhaps, translate their losses into an exact loss of good will, although this response must be far from perfect. From the broadest viewpoint, however, in order to accomplish the greatest good for the greatest number of people, it would appear to be the obligation of the power company to evaluate outage in terms of the resulting economic loss. This approach simplifies the problem exceedingly, by suggesting that the unit outage cost may be measured in simple ratio to the kwhr of service lost, whereas if customer dissatisfaction were to be measured, the additional complicated psychological effects on the customer of frequency and duration would become involved.

Referring to the determining factors governing economic loss as given in (a) to (e) inclusive above, outage losses will probably average to vary in fairly direct proportion with items (a), amount of load affected, and (b), duration of interruption, notwithstanding the fact that in isolated cases of outage an exceptionally large initial loss does not grow proportionately with time and vice versa. The importance of (a-1) is held to be great only in so far as it governs the amount of load affected. Item (c), nature of use, varies greatly among individual customers, but when a sufficient number of diversified customer outages including residential and commercial loads are grouped together, the individual variations disappear, and nature of use can be treated as a constant factor. Items (d) and (e) can be regarded as constant for the area served by any company over the period of time under consideration. When a sufficient number of individual customer outages are grouped together, the economic cost of outage can then be computed as being in fixed ratio to items (a) and (b), times a constant, which is fixed by items (c), (d) and (e). Since items (a) and (b) are measured by the total kwhr of energy interrupted, the monetary equivalent of the outage loss suffered by a diversified group of customers may be estimated as being in direct proportion to their combined kwhr outage.

The proposition that it is possible to determine a useful monetary equivalent for outage rests, then, wholly on the assumption that the value shall be used

only where a diversified group of customers is concerned. It is recognized at the outset, that only serious error could result from any attempt to estimate on the basis of a standardized money equivalent, the loss due to an outage sustained by a very few customers, or due to a series of outages to a single customer, because of the wide variation in nature of use. The use of an outage valuation is especially adaptable to transmission and distribution system problems, because troubles are relatively so numerous and the affected customers so diversified that they can be treated statistically.

For practical purposes, it is preferable to measure transmission and primary circuit outages on the basis of connected transformer kva-hr capacity rather than actual kwhr load interrupted, and it is assumed that for each power system there is an acceptably uniform ratio between these two figures. It is concluded that the loss due to service outage can be satisfactorily recorded in the trouble analysis in units of connected transformer kva-hours.

The second step consists in determining the equivalent monetary loss imposed by each kwhr of outage. Each type of economic loss listed above can be made the subject of an individual estimate on the best logical basis which can be found. Total industrial production, for instance, divided by total industrial kwhr consumed, yields the unit economic loss due to outage of industrial load. Similarly, loss of comfort due to domestic outage can be gaged as the ratio between the value of residence use divided by the domestic electric load. In corresponding ways, it is possible to make a fair estimate of the overall economic value of a kwhr of electricity.

(3) Cost of service outage may be variously estimated on any or all of the following bases:

(a) How much the management would be willing to spend annually in order to eliminate all outage.
(b) At what rate the individual would desire compensation in order to consider outage of his own service immaterial.
(c) Working backward from past decisions in which expenditures were made to improve service.
(d) Direct estimate.

The unit outage equivalent obtained by these methods can be compared with the result obtained by the summation of economic losses described under (2). Whatever final value is arrived at in this way by any company, is probably many times the revenue loss due to outage, and can be regarded as a universal "service standard" for that company.

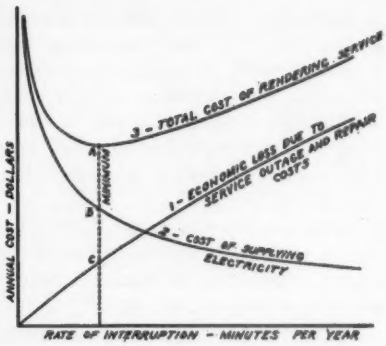
3 - TOTAL COST OF RENDERING SERVICE
1 - ECONOMIC LOSS DUE TO SERVICE OUTAGE AND REPAIR COSTS
2 - COST OF SUPPLYING ELECTRICITY
A
B
C
MINIMUM
ANNUAL COST — DOLLARS
RATE OF INTERRUPTION - MINUTES PER YEAR

Fig. 2—Diagram Showing Relation Between Cost of Supplying Electricity and Quality of Service.

A = Minimum Net Cost of Rendering Electric Service.
B = Point at which System Design Should be Adjusted to Obtain Maximum Economy.
C = Optimum Degree of System Reliability.

Determining Condition of Maximum Economy

The correct solution to each individual problem in distribution system design is the one which results in the least overall cost to the community. Some kinds of trouble, such as transmission cable failures, normally cause extensive plant damage, but slight customer outage. Other troubles, such as pole type tie switch failures frequently cause large amounts of outage through the interruption of two entire circuits, to which the loss of the switch itself does not compare in seriousness. Being in possession of a method for converting outage into equivalent dollars' loss, we can, for practical purposes, say that for every type of trouble:

Average Cost of Service Outage + Average Cost of Location and Repairs = Average Net Cost Per Trouble

Once the unit cost of outage has been established, the net cost of rendering electric service can be taken as the total cost of supplying electricity plus the total cost of troubles including loss due to service outage. In general, an inverse relationship applies between these costs for each type of apparatus or construction method used, as represented in Figure 2. As the cost of furnishing electricity (curve 2) is increased through the use of improved designs and materials and the installation of additional spare and protective equipment, service failures will decrease and repair and outage costs (curve 1) will drop. The total cost of giving service (curve 3) is the sum of curves 1 and 2. Construction should be adopted which will operate at the indicated point of minimum total cost A. This can be accomplished by building the system to the standard of quality B shown on curve 2, which will then operate with a degree of service reliability resulting in trouble and outage costing C on curve 1. From these curves, it can be seen that *it is ultimately as unjust to the customer to give too high a grade of service as to give too low a grade.* When demanding improved service, some customers do not realize that the company is acting as custodian of a certain amount of their money.

Use of The Trouble Analysis

When distribution system troubles are tabulated in the manner described, the types of operating troubles which are most numerous and cause the greatest outage become conspicuous and may be subjected to special study. Investigations are also indicated when the trend of individual trouble and outage rates are observed to be increasing from period to period.

When special study is decided upon, fully detailed information may be drawn from the classified daily record, which being already available, renders any tedious search through bulky trouble files unnecessary.

In addition to pointing out the specific weaknesses in a distribution system, the system trouble analysis also gives the management of a company a clear conception of the general weaknesses in the organization. The six general cause classifications, with corresponding broad correctives, are listed as follows:

Class of Trouble	*Corrective*
1. Natural conditions	(a) Study adequate design and construction methods.
2. Foreign agencies	(a) Study adequate design and construction methods. (b) Educate public. (c) Obtain cooperation of other utilities.
3. System inadequacy	(a) Appropriate money to modernize plant. (b) Increase personnel to complete inspections, according to schedules, based on experience.
4. Defective equipment	(a) Improve specifications and inspection of purchased materials and apparatus. (b) Standardize materials and apparatus. (c) Establish or increase field inspections.
5. Personnel failures	(a) Conduct educational programs and construction schools. (b) Improve supervision. (c) Issue specifications and rules.
6. Unknown	(a) Conduct or increase technical fault analysis.

The system trouble analysis also may enable different utilities to compare operations on a common basis, and to prove the relative success of various engineering and construction methods.

Having determined from the analysis

which trouble items most deserve attention from a standpoint of frequency and service outage, ways and means are considered for remedying these troubles economically. The specific problem in each case is to compare existing net operating costs against estimated operating costs after applying the proposed corrective. These comparisons are most satisfactory when made on an annual cost basis, rather than on the basis of total initial costs, because operating and maintenance charges are not easily included in lump-sum comparisons.[5]

To specifically illustrate one of the uses of the System Trouble Analysis, let a typical hypothetical year's trouble and outage record for an overhead distribution system as shown in Table I be considered.

It is immediately evident from data in Table I that wire troubles and tree troubles are the most serious causes of customer outage on overhead systems, and demand first consideration when attempts are made to improve service.

Conspicuous in this table is the fact that although wire troubles occur at about the same rate on both primary and secondary systems, the rate of customer outage due to primary wire troubles is in the neighborhood of 40 times greater than that due to secondary wire troubles. This strongly indicates that the practice of using identical types of supports, insulators and conductors for both primary and secondary distribution circuits should be questioned. A special study of all ways and means for reducing primary line troubles is strongly suggested from the trouble record, and the correlated question as to whether or not the secondary line is too expensively constructed also arises.

For purposes of illustration let it be assumed that in addition to the existing practice of using tree wire and tree molding, and trimming trees on regular program, three new methods for reducing line troubles are investigated, through an economic study as given in Table II.*

The conclusions from this study, drawn on the basis that the application of any corrective should show an appreciable profit, and on the basis of the stated assumptions only, are:

1. New primary line extensions should be made with improved line wires installed in alternate pin positions on the crossarms.
2. When vacant pin positions are available on primary crossarms, wires should be installed with double spacing, on both new and existing plant.

Returning to Table I, for the purpose of further illustration, it is also evident, that the most serious individual trouble that can occur is the failure of an oil switch, which produces an average service outage of 1000 kva hours of connected transformer capacity.

When engineering corrective measures, the total average cost of an oil switch failure may be determined as the sum of (a) average outage times average cost per kva hour of outage plus (b) cost of damage to switch plus labor for replacement. If the average cost per switch failure is determined in this manner, for example, as $350, then with the given failure rate of 9 per 1000 switches per year, the annual trouble cost per switch is:

$$\$350 \times \frac{9}{1000}$$ or approximately $3 per switch per year.

If the switches have no lightning protection, and it is found from the trouble analysis that half of the switch failures or 4.5 per 1000 are due to lightning, then an annual charge not exceeding $1.50 per year per switch would be the limit of the amount of money that could be spent economically to completely eliminate the lightning failures.

If the average cost of completely protecting oil switches against lightning with lightning arresters is estimated to be $30, the annual carrying charges on this protection at 15% will be $4.50 per year. This forces the conclusion that even though lightning arresters were 100% effective in preventing switch failures, there would be no justification for their general application to pole type switches.

Suppose now, that a special analysis of switch troubles reveals that the average failure rate of 4.5 per 1000 due to lightning can be broken down into

2 per 1000 for line switches
30 " " " tie "

and further, that the average outage is greater per tie switch failure than per line switch failure. On this basis it may be found that tie switches alone as a class may merit the annual expenditure of money not to exceed $15 per year to completely eliminate all lightning troubles.

If lightning arresters are 75% effective, $11.25 in trouble costs can be saved each year by the application of arresters

*Note: This study is intended to demonstrate the utility of the method only, and should not be construed as proving the relative merits of the methods of line construction mentioned.

TABLE I—CONDENSED ANNUAL TROUBLE AND OUTAGE RECORD OF AVERAGE OVERHEAD DISTRIBUTION SYSTEM BY EVIDENCES ONLY

Annual Troubles Rate by Evidences: Outage Troubles Only		Average Outage Per Trouble	Outage Rate; Average Secondary Customer
	Primary Distribution		
150	Circuit Interruptions per 1000 Circuits	225 Connected kva hours	2.0 Minutes per year
12	Tree Troubles per 1000 Miles Primary Wire	300 " "	3.0 " "
18	Wire Troubles per 1000 Miles Primary Wire	360 " "	6.5 " "
0.1	Pole Troubles per 1000 Poles	200 " "	0.8 " "
9.0	Transformer Troubles per 1000 Transformers	50 " "	0.8 " "
10	Fuse Troubles per 1000 Fuses	20 " "	0.5 " "
9.0	Switch Troubles per 1000 Switches	1000 " "	0.9 " "
25	Miscellaneous Troubles per 1000 Miscellaneous Units	....	0.5 " "
		Total	15.0 " "
	Secondary Distribution		
8.0	Tree Troubles per 1000 Miles Secondary Wire	5.5 Connected kva hours	0.07 Minutes per year
20	Wire Troubles per 1000 Miles Secondary Wire	4.5 " "	0.15 " "
0.4	Pole Troubles per 1000 Poles	5.5 " "	0.03 " "
0.2	Miscellaneous Troubles per 1000 Miscellaneous Units	....	0.25 " "
		Total	0.50 " "
		Grand Total	15.5 " "

TABLE II—ECONOMIC STUDY OF VARIOUS METHODS OF REDUCING PRIMARY LINE TROUBLES

	(a) Application of Improved Line Wire in Alternate Pin Positions on Crossarms	(b) Application of Improved Line Wire in all Pin Positions on Crossarms	(c) Use of Double Wire Spacing Where Pin Space is Available
1. Estimated Reduction in Rate of Tree Troubles Causing Outage	45%	55%	20%
2. Expected Reduction in Trouble Rate (from Table I) through application of Corrective	5.4	6.6	2.4
3. Estimated Annual Saving per 1000 Mi. of wire if Cost of Outage plus Repairs is $100 per Trouble	$540	$660	$240
4. Estimated Reduction in Rate of Tree Troubles not Causing Outage	70%	80%	50%
5. Expected Reduction in Trouble Rate through application of Corrective	5.6	6.4	4.0
6. Estimated Annual Saving per 1000 Mi. of wire if Cost of Repairs is $8 per Trouble	$45	$50	$30
7. Estimated Reduction in Rate of Wire Troubles Causing Outage	55%	65%	20%
8. Expected Reduction in Trouble Rate through Application of Corrective	9.9	11.7	3.6
9. Estimated Annual Saving per 1000 Mi. of wire if Cost of Outage plus Repairs is $115 per Trouble	$1,140	$1,350	$414
10. Estimated Reduction in Rate of Wire Troubles not Causing Outage	75%	85%	50%
11. Expected Reduction in Non-Outage Trouble Rate through Application of Corrective	2.3	2.6	1.5
12. Estimated Annual Saving per 1000 Mi. of wire if Cost of Repairs is $6 per Trouble	$14	$16	$9
13. *Total Annual Savings in Trouble Costs per 1000 Miles of Primary Wire Through Application of Correctives—(Sum of 3, 6, 9 and 12)*	$1,740	$2,080	$690
14. *Estimated Cost of Correctives per Average 1000 Miles of Wire*			
(a) If Corrective is Applied to New Plant Construction Only	$3,900	$15,500	0
Rate of Annual Charges on Corrective	9%	9%	6%
Annual Charges for Corrective	$350	$1,400	0
(b) If Corrective is applied to Existing Plant	$14,300	$57,200	$1,300
Rate of Annual Charges on Corrective	9%	9%	6%
Annual Charges for Corrective	$1,290	$5,150	$80
15. Net Annual Saving per 1000 Miles of Primary Wire through Application of Corrective.			
(a) If Corrective is Applied to New Plant Construction only	$1,390	$680	$690
(b) If Corrective is Applied to Existing Plant	$450	Loss	$610
16. Annual Profit on Investment in Corrective.			
(a) If Applied to New Plant Only	35%	4%	(No additional investment required)
(b) If Applied to Existing Plant	3%	Loss	47%

costing $4.50 per year, representing a net economic gain of $6.75 per tie switch per year.

Before putting into effect the conclusion that arresters should be installed at all tie switches, however, all other means for accomplishing a similar result should be examined, since it might possibly be found that the use of an improved switch, or the adoption of some alternative disconnecting device would produce an even greater saving than that indicated by the application of lightning arresters.

The above examples are intended to serve as illustrations of the more important practical application of the System Trouble Analysis. Many other uses will be discovered, however, when the data have been made available.

For troubles which are of frequent occurrence, the information obtained from the system trouble analysis will be of maximum value, and economic correctives can be engineered with considerable accuracy. The use of annual trouble costs in justifying correctives becomes less valid as the frequency of trouble incidence and the diversification of customers involved decreases. It is possible, nevertheless, to make valid studies of single troubles even though they are so infrequent that they do not appear previously in existing records, provided a sufficient number of customers are affected by each. In such cases it is to be decided whether or not a corrective is justified on the assumption that such a trouble will not occur more than once in each interval of time equal to that covered by the records. A determination of annual trouble cost on this basis has the merit that it may rule out, although never positively justify, certain correctives. For example, in deciding whether or not to make routine tests on transmission lines, the economics for a certain line which had never failed during 11 years' operation were computed on the basis that the failure rate for the line did not exceed 1/11 or 0.09 failures per year. This definitely eliminated this line from the testing group until such time as sufficient failures had occurred to increase this tentative failure rate.

Another but less direct method for making economically justified improvements is through the redistribution of costs. From a study of the trouble and outage record, it may be observed that certain sub-divisions of the system are operating so free from trouble that they can be adjudged to have been designed with excessive safety factors, and it can be estimated with fair certainty that the simplification or elimination of certain apparatus in this sub-division would save considerable money, yet not result in appreciably increased trouble and outage costs. Conversely, other classes of troubles can be found where the expenditure of a relatively slight amount of money will make a sizable reduction in trouble and outage rates. By diverting money

from the over-reliable to the under-reliable apparatus, the net cost of the electrical system will not be appreciably changed, yet the outage will be greatly reduced. For example, the economics of using improved line wire for primaries, instead of being approached on the basis previously discussed, could be approached from the standpoint that if the possible saving through substitution of bare for weatherproof secondary line wire were to be allotted to defray the increase in cost resulting from the adoption of the primary line wire with an improved covering, the resulting net cost of line construction might be equal to or less than the existing cost, whereas the amount of customer outage would undoubtedly be vastly reduced.

When the operation of generating, transmission, and primary and secondary distribution systems is analyzed and compared according to the method described, it will probably be found that certain systems are relatively out of balance. In other words, the "service standards" of the different systems may not have happened to be congruous. In general, it will probably be found at present by most operating companies that primary distribution systems have not been designed to give adequate reliability when compared with that of all other systems.[1, 3] This may largely be the unfortunate result of the existing practice of weighing service reliability on the basis of judgment alone. This condition cannot be corrected by any single change in construction or operation, but must depend upon a large number of changes, each one of which is based upon an individual economic study in which performance records are evaluated.

It is of interest to consider some of the results of the application of the system trouble analysis to the distribution system of The Edison Electric Illuminating Company of Boston. Prior to 1929, the troubles that were studied were those which attracted special attention through extended service outages of public disturbances. During the period from 1929 to 1933, the more numerous and less spectacular types of system troubles were studied and although undue attention was given to certain individual troubles, considerable improvement in operation was achieved. Since 1933, troubles have been approached solely on the complete statistical basis described with the result that a sharp decrease has been realized in distribution trouble and outage rates and in operating costs. Over the seven-year period the combined troubles on the transmission, primary, and secondary distribution systems have been decreased about 40% and the customers' service correspondingly improved.

Typical important corrective measures guided by economic studies are:

(1) The application of lightning arresters to distribution transformers in areas of high trouble rate and to primary riser cables where sheaths were isolated from station grounds.
(2) The discontinuance of the use of tree insulators in favor of wax impregnated tree molding.
(3) The practice of double-spacing primary line wires on crossarms when pin space is available.
(4) Modernization of distribution transformers.
(5) An extensive tree-trimming program.

The comparative absence of outage due to secondary distribution failures as shown by the trouble analysis has been a guide to changes in several practices previously considered necessary or desirable to the operation of that system, such as:

(1) Simplification of secondary riser construction.
(2) General reduction in secondary cable insulation and sheath thickness.
(3) Adoption of less expensive grade of rubber insulation for secondary wires and cables.

Conclusions

1. A systematic procedure for collecting, analyzing, classifying, and tabulating distribution system troubles and outages is a fundamental necessity to power system managements.

2. The economic loss due to customer outages may be converted into a monetary equivalent, which should be based on the average economic loss incurred per kwhr of service interrupted.

3. Most decisions affecting general design and operating problems in which service reliability is a consideration, may be made upon a more sound economic basis, if the trouble record is consulted, and outage, converted into its monetary equivalent, is properly used in the cost study. Power systems can be brought toward a state of thorough economic balance through this practice.

Considering the amount of money now spent to safeguard service reliability, it is reasonable to believe that a small fraction of this amount spent to direct these expenditures should be a splendid investment. The specific method of tabulating distribution system troubles described in this paper has been developed through the cooperation of a group of large power companies. It is suggested that the adoption of the same or similar schemes by more companies will prove to be of value to the users and will provide a source of data by means of which the industry may make improvements in, and constructive comparisons of, different power distribution engineering and construction methods.

APPENDIX A

Glossary of Terms Used in the System Trouble Analysis

A. General Directions

1. *Cause of Trouble*

A "cause of trouble" is an agency, or combination of agencies, acting upon a system irregularly to produce customer outage, damage to the system, an abnormal electrical condition on the system, or any combination of three. Exception: Any case in which the customer outage is caused by the customer himself, and neither the system nor any other customer is affected, is not considered to be a "cause of trouble."

2. *Evidence of Trouble*

An "evidence of trouble" is that component part of a system upon which a cause of trouble has acted.

3. *Trouble*

A "trouble" is considered to be the event of one or several common "causes of trouble" acting to produce one or several "evidences of trouble."

4. *Non-Inherent Trouble*

A trouble is considered to be "non-inherent" if its cause originated outside of the power company's system, that is, if it was due to natural conditions or foreign agencies.

5. *Inherent Trouble*

A trouble is considered to be "inherent" if its cause originated within the power company's system, that is, if it was due to system inadequacy, defective equipment, or personnel failure.

6. *Interruption*

"Interruption" is the cessation of electric service through failure of the electric power system at any point and is measured by the

(*Continued on page* 430)

National Accounting Conference to Be Held in November

Large Attendance Expected at Detroit

PLANS and program for the Accounting Conference at Detroit next month under the auspices of the Institute Accounting Committee are completed and a large attendance from both member and non-member companies is anticipated, according to Bernard S. Rodey, Jr., Chairman. The conference will take place at the Book-Cadillac Hotel, Detroit, on November 8, 9 and 10. A condensed program is printed on the next page.

Following the national interest displayed at an enlarged accounting meeting held at the time of the national convention of the Institute in June at Chicago, the Accounting Committee felt it would be desirable to call a general Accounting Conference this fall.

Preliminary surveys and communications indicate a substantial general national interest and enthusiasm in favor of the conference.

For the past several years the Accounting Committee has been confronted with matters relating to changes in the Systems of Accounts in various states and by proposed Uniform Systems prepared by the Committee on Statistics and Accounts of the National Association of Railroad and Utilities Commissioners. The Federal Power Commission System of Accounts has now been prescribed and similar systems have been recommended for adoption in the several states. Fully one-half of the industry at the present time is or soon will be operating under these Systems of Accounts. In addition to the new Systems of Accounts, the Federal Power Commission and the National Association of Railroad and Utilities Commissioners have adopted or are in the process of adopting new forms of Annual Reports.

On several occasions the Accounting Committee has cooperated with the various regulatory bodies in studying these matters and has presented to such conferences comments, suggestions and criticisms, some of which have been accepted.

The industry is now confronted with problems and changed procedures brought about by the new accounting orders. Many interpretations and studies will be necessary before these new systems can be made fully effective and it will probably be sometime before the depths of the various problems can be determined and a solution arrived at. It is believed that at this time an exchange of ideas will be helpful in the ultimate solution of the many problems and that an expansion of the Accounting Committee along specialized lines and studies which will result from these Committee activities can be of material assistance to the industry. For the purpose of accomplishing this result, the Accounting Committee has organized a number of accounting groups to deal with the specialized subjects and at the present time these committees are quite fully organized and will have their first meeting in Detroit.

The primary purpose of the Accounting Conference is to obtain a very frank overall discussion of the details of some of the problems which confront us at this time and lay a foundation for future studies of these specialized groups.

INFORMAL DINNER
Crystal Ballroom
Book-Cadillac Hotel
Detroit
7:00 P.M.
Tuesday, November 9th

Toastmaster:
Mr. Bernard F. Weadock

Guest Speakers:
Mr. C. M. Breitinger—
"Accounting Highlights on Certain New Laws"

Mr. J. F. Fairman—
"Engineering and Accounting Economics"

Dean John T. Madden—
"Accounting Jurisprudence"

Tickets available at registration desk

In general, the Conference program will be as follows:

Monday Morning, November 8, will be devoted to general registration and to committee meetings for members. General sessions will open Monday afternoon, with a discussion of various joint conferences which have been held with the F. P. C. and the N. A. R. U. C. by accounting representatives of the A. G. A. and E. E. I. Committees relating to the Uniform Systems of Accounts, report forms, and the preservation and destruction of records. Sales Promotion and Merchandise Accounting will also be put before the meeting that afternoon. This program has been planned by a General Accounting and Records Committee, F. P. Dexter, Chairman.

The program for Tuesday, November 9, has been arranged by the Plant Accounting and Records Committee, J. V. Cleary, Vice Chairman. A full day will be devoted to the new problems relating to Plant Accounting and Records. Needless to say at this time not all of the problems involved in this subject can be covered but it is hoped that the papers and discussions following will at least pave the way to future constructive progress. Tuesday will also feature an informal Dinner Session in the evening. The speakers at this dinner will be Bernard F. Weadock, C. M. Breitinger, F. J. Fairman, and John T. Madden.

Wednesday's program has been prepared by the Customers' Relations, Commercial Accounting and Collections Committee and the Purchasing, Stores and Transportation Committee, Chairmen, K. E. Boyle and E. S. Brock respectively. The program prepared will deal with many new subjects of national interest under these headings.

The detailed program outlining the scope to be covered by each of the subjects here listed and personnel of the committees has been printed and forwarded to the industry by direct mail. Additional copies are available at the Institute offices, New York City.

Please make reservations *direct* to the Book-Cadillac Hotel, Detroit, Michigan.

Condensed Program

First National Accounting Conference

of the

EDISON ELECTRIC INSTITUTE

Book-Cadillac Hotel, Detroit, Michigan

November 8, 9, 10, 1937

Presiding—Bernard S. Rodey, Jr., Chairman, Accounting Committee, Assisted by Past Chairmen Messrs. Kohlhepp, Stewart and Lobban

Registration and Committee Meetings

Monday Morning, November 8

9:00 A.M. Registration of members and industry delegates—Foyer adjacent Italian Garden

9:30 A.M. *Committee Meetings* (Members only)

General Accounting and Records—Chairman, F. P. Dexter—Washington Room, Fifth Floor

Plant Accounting and Records—Chairman, H. D. Anderson; Vice-Chairman, J. V. Cleary—Reception Room, Ballroom Floor

Customers' Relations, Commercial Accounting and Collections—Chairman, K. E. Boyle—Founders' Suite, Fifth Floor

Purchasing, Stores and Transportation—Chairman, E. S. Brock—Parlor "H," Fifth Floor

12:00 Noon Business Meeting—Accounting Committee—Normandie Room, Ballroom Floor

General Sessions—Italian Garden

Monday Afternoon—November 8

2:30 P.M. Opening remarks of Chairman and introduction of guests

Open Discussion—C. E. Kohlhepp, presiding

(Program arranged by the General Accounting and Records Committee—F. P. Dexter

3:00 P.M. *Review of General Aspects of New Federal and State Systems of Accounts*—C. E. Kohlhepp, F. P. Dexter

3:30 P.M. *Sales Promotion and Merchandising Accounting*—E. S. Lanning, William Avery

4:15 P.M. *Annual Reports to Commissions*—G. U. Stewart, C. R. Landrigan

5:00 P.M. *Preservation and Destruction of Records*—Emil Ulbricht

Tuesday Morning—November 9

Open Discussion—Bernard S. Rodey, Jr., presiding

(Program arranged by Plant Accounting and Records Committee—J. V. Cleary, Vice-Chairman)

9:00 A.M. *Original Cost Determination and Related Matters*—J. V. Cleary, H. L. Gruehn, H. W. Endres, J. M. Burchill

10:00 A.M. *Retirement Units — Maintenance Replacements*—John Dockendorf, J. L. Sunday

10:45 A.M. *Treatment of Reconstruction Costs*—W. H. Ebbecke, F. J. Brett, E. Hery

11:30 A.M. *Transmission and Distribution* — J. M. Kramarsik, S. W. Kittleman, H. W. Boozer

Tuesday Afternoon—November 9

Open Discussion—G. U. Stewart, presiding

(Plant Accounting and Records Committee—continued)

2:00 P.M. *Treatment of Construction Overheads and Indirect Costs*—S. L. Ferguson, G. U. Stewart, Morris Tracy, J. B. Crumb

3:00 P.M. *Plant Inventory Problems*—H. Edwin Olson, J. H. Lobban, H. P. Taylor, H. W. Alrich

4:00 P.M. *Depreciation Accounting*—M. R. Scharff, F. B. Flahive, F. W. Cooper, J. H. Bissell, C. P. Zimmerer

7:00 P.M. Dinner (Informal)—Crystal Room, Ballroom Floor

Toastmaster—Mr. Bernard F. Weadock

Guest Speakers—Mr. C. M. Breitinger—*"Accounting Highlights on Certain New Laws"*; Mr. J. F. Fairman —*"Engineering and Accounting Economics"*; Dean John T. Madden—*"Accounting Jurisprudence"*

Wednesday Morning—November 10

Open Discussion—J. H. Lobban, presiding

(Program arranged by: Customers' Relations, Commercial Accounting and Collections Committee—K. E. Boyle. Purchasing, Stores and Transportation Committee—E. S. Brock)

9:00 A.M. *Effective Methods of Building Satisfactory Public Relations*—P. J. Braheney, E. N. Keller

9:30 A.M. *The Meter Reading and Customers' Accounting Departments—Their Relationship*—W. H. Waterbury, P. F. Gow, L. M. LaPorte

Elimination of Final Billing for Customers Not Permanently Discontinuing Use of Service—G. B. Webber, H. T. Terry

10:00 A.M. *Present Trends in Credit and Collection Policies*—W. D. Dyer, O. J. Vosbrink

10:45 A.M. *The Value of Customer (Credit) History Records*—K. E. Boyle, J. A. Williams

11:00 A.M. *Coordination of Stores Classification for Purchasing and Storeroom Control*—G. McDougall, Carl H. zur Neiden

11:20 A.M. *Application of Machine to Stores Accounting* —Arthur Ziegler, J. A. Herlihy, J. Krohn

11:45 A.M. *Transportation*—K. C. Campbell, T. R. Harber, C. W. Engstrom

Wednesday Afternoon—November 10

Open Discussion—Bernard S. Rodey, Jr., presiding

2:00 P.M. *Social Security Accounting*—H. A. Ehrmann and others

3:30 P.M. *Cost Allocations in Combination Companies*—H. C. Davidson, P. R. Williams

Thursday, November 11

Elective

The Detroit Edison Co. has very kindly extended an invitation to conferees for tours and inspection trips through the various Accounting Departments of that company. Detailed arrangements will be made at the Monday morning meetings of the respective committees and announced during the conference.

Light in the Schoolroom

By Edward Jackson, M.D.

Read in the Symposium on Health Problems in Education, under the sponsorship of the National Education Association and the American Medical Association, Atlantic City, N. J., June 8, 1937. Reprinted from the *Journal of the American Medical Association*

THE COMMAND "Let there be light" was the beginning of creation, and all created life has found it "was good." Plants and animals transform the force of the sun's rays into food and life. The human race, in all languages, has used light to interpret joy, hope, intelligence, information, truth. The contrast of light and darkness explains the contrast of good and evil.

Each day in the past winter I have watched the children running to school, shouting to one another, happy to greet one another, to get together for a few minutes outdoors on the playground. It seemed so different from Shapespeare's picture of "the schoolboy with shining morning face, creeping like a snail, unwillingly to school." There seemed no reason for this contrast except that the playground was out in the sunlight and the schoolroom was in comparative darkness. Perhaps the schoolrooms were even worse in Shakespeare's time than they are today.

The bright joy of childhood comes to the child in the sunlight. There is no reason why he should be deprived of it. Long ago the fear of enemies drove cave dwellers into darkness or into forts for protection, or people have been driven into houses for rest. These have made the darkness of the shut in and have made us tolerant of poor lighting. Our churches for introspection and colleges for instruction have given to near-darkness a prestige and toleration that make them suggestive of learning. But the child has lived outdoors in all ages, drawing health, strength, stimulus and joy from the sunshine. It is a serious change from the free, self direction of childhood — the following of race instincts and the outlet in games that have been played for generations until they fit in with the natural development—to the performance of imposed tasks, justified only by the preparation to meet the needs of later life. This change is made more difficult by the requirement of giving up, with freedom of conduct, the stimulus of good light.

If school could begin with two years of supervised play, in outdoor playgrounds, with full light, it would help to get the full cooperation of the child. Loss of the child's hearty, interested cooperation is the first grave error of our educational system. It is a more serious error than we have known. It has set up an opposition between natural desire and suggested tasks, between normal activity and purposeful occupation, between what we want to do and what is expected of us. It sets up a conflict between study and health. Those who most need health sacrifice it for study. Those who most need opportunities of study throw them away to cultivate the natural desire for health and bodily vigor. Failure to recognize the child's inherited need and enjoyment of light outweighs in effect much of our labor on the curriculum and skill in pedagogy.

More than all else, it lowers the child's standards of health as a main objective. This is a loss which even a lifetime study of health and the health interests of patients fails to restore wholly. Let us understand this in preparing to deal with all the health problems in the schools. We, who have to consider the problems of vision in the schools, are constantly being reminded, and are often baffled, by the low standards of lighting needs that are prevalent in the community.

The light standards of the children are the light standards of the human race, the light standards of savage men who hunted and fought and worked under the open sky. They are the light standards of the higher animals that see their food and their enemies by the light of day; not that of the owl, the hyena or even the wolf, guided by the sense of smell and mainly hunting at night. The child's standards must also include those of macular vision; to recognize the minute differences in the forms of letters, textures and structures, which require more light than the objects perceived in the peripheral field of vision. The only standards acceptable for the school are those of optimal vision—the highest visual acuity, the easiest and quickest vision, good light on a cloudy day and in the morning and evening.

If we wish to inculcate principles of justice, we must practise equal justice in the essentials of school life. A physician who became the health officer of his city and the president of his state medical society knew, as a boy, that he was near sighted. But his father did not "believe" that boys should wear glasses, and his teacher's ideas of justice did not include peculiarities or disabilities of particular boys. His teacher wrote something on the blackboard and told William to read it from his seat. William said "I cannot see it." "Yes, you can," said the teacher, and told the next boy to read it, who read it promptly and easily. "Now you can see it," said the teacher. "I can't see it," repeated William. Then, as William told it when he was president of the medical society, "he boxed my ears and gave me ten demerits."

With the light meters of the present day, the light that falls on each desk and book can be measured in every part of the schoolroom. Doing this in some of the best lighted schoolrooms of Denver, we found that the light at the bottom of the windows opening to the clear sky was from 100 to 200 foot-candles. On the tops of the row of desks nearest these windows it was from 40 to 50 foot-candles. On the desks farthest from the windows it was from 5 to 10 foot-candles, and on the blackboard smeared with chalk, on which were written things for all the children to read, it was always less than 10 foot-candles; in some parts of the room the eyes had also to contend with glare of the reflections of the windows.

In the School Clinic of the University of Colorado Medical School, we found two sisters who had reached the seventh and eighth grades in school and who kept up with their classes. This doubtless depended on their using very strong light and getting much help from other members of their family, for they each had 15 diopters of hyperopia—more than is commonly left after removing a cataract

(*Continued on page* 435)

McGraw Prize Paper

Practical Aspects of Cavitation and Pitting

PART II*

By J. M. Mousson

A COMPARISON of Figs. 17, 18 and 19 gives a good illustration regarding the effect of different processing upon the grain structures under identical heat treatments of stainless chromium steels similar in chemical composition. What may be accomplished by heat treating even with low alloyed steels is indicated by the high resistances attained with the chromium molybdenum steels (Table II, Specimens No. 22 to 24 incl.). A somewhat larger range in resistance was observed by the treated rolled stainless 12% chromium steel series on Table VI, Specimens 90 to 93 inclusive. In connection with this particular group under consideration another interesting fact comes to light. Comparing the losses of No. 90 and No. 97, it is realized that for some reason a very much larger loss was obtained with the harder material. From the chemical composition it may be noted that No. 97 is a stainless chromium steel of free machining quality. In this case the machinability was improved by additions of sulphur. From the microphotographic analysis (see Fig. 20) it is apparent that sulphur is present in form of flakes. As referred to above flakes are undesirable as stress concentrations are likely to ensue. Furthermore, it may be realized that impurities or non-metallic inclusions, and sulphur in this case may be regarded as an impurity, are detrimental because they are often the origin of fatigue cracks or facilitate their progress. (See Fig. 21.)

A similar phenomenon is responsible for the comparatively large losses obtained with the forged stainless 14% and 17% chromium steels referred to on Table VII. Here the carbide rich areas (see Fig. 22) seemed to permit a fast development and progress of the fatigue cracks.

Generally speaking rolling and forging are superior to casting, as higher physicals may be obtained. The former two manufacturing processes may, however, be detrimental in cases where a laminated grain structure is obtained conducive to separation along parallel grain layers. This weakness is particularly noteworthy with large grains and may be of minor or no importance with a greatly refined grain structure where more developed interlocking is provided. (Compare Figs. No. 18 and No. 23.)

There is not only a difference to be expected by the various manufacturing processes such as casting, rolling, forging, but the method used in carrying out a certain process may also be of far reaching importance. For example, in casting the rate of cooling can be varied. Heat may be dissipated more quickly in chilling the molten metal in a cast iron mold instead of using sand. The more rapid the cooling the less conducive to grain growth is the material and the higher may be the resistance to cavitation. This is borne out by a loss comparison of specimens No. 70 with 71 on Table V, No. 138 with 139 and No. 141 with 142 on Table VIII.

The size of the grain can also be influenced by means of alloying elements such as vanadium and molybdenum. Care must be exercised with molybdenum as it may in certain cases soften the alloy and nickel may have to be added to compensate for this effect. An interesting comparison is afforded by the results of three groups consisting of three specimens each on Table V. They are Nos. 60 to 62, Nos. 67 to 69, and Nos. 76 to 78 inclusive. For all three groups, consisting of stainless 12% chromium steels the heat treatments were identical. Comparing the first group with the third mentioned the beneficial influence of molybdenum may be noted. Instead of using molybdenum for grain refinement nickel was added in the second group to increase the physicals, which will also improve the resistance as is borne out by comparing the losses of the first two groups.

The effect of nickel may be further demonstrated by a comparison of the results obtained with specimens Nos. 70, 72 to 75 inclusive. Here the losses were reduced by successive additions of nickel. It may be mentioned that the grain structures of this series were exceedingly coarse explaining the relatively large losses obtained with no or small nickel additions in spite of the elevated hardness when compared with specimens of the same general composition. The influence of the coarse grain structure in this group is another typical example that grain size is of utmost importance and should not be overlooked when consideration is given even to high alloyed steels.

2. Surface Treated Materials

From Table X it is apparent that surface treatments may not always give the desired improvement in resistance. The protection afforded obviously depends upon the depth to which the treatment penetrates as well as the nature of the treatment itself. The large losses obtained with the chapmanized and nitrided materials were due to the shallow depth and brittleness of the skins. The penetration with chapmanizing was deeper than with nitriding and it is for this reason that a smaller loss was obtained with the former surface treatment. The shallowest penetration showed the alumilite finish, the skin being only .001 inches in depth. On the other hand the high resistance of the stainless clad is not surprising because the 1/16 inch clad is sufficient to permit adequate stress distribution.

The results obtained with the cloudburst hardened materials are of interest. Two types of materials were tried, one being Safe Harbor turbine steel and the other rolled 18-8 stainless chromium nickel steel. Since cloudburst hardening is a cold working process, in some respects similar to cavitation, higher losses could have perhaps been anticipated for the treated specimens than for those in natural condition. This, however, is not borne out by the results. Although both types of punishment are similar in nature there is a fundamental difference in the area of stress application. The

*Part I of this paper, together with the Bibliography, was published in the September, 1937 issue of the E.E.I. BULLETIN. Reprints of the complete paper may be obtained from the Institute, 420 Lexington Ave., New York, N. Y.

Fig. 17, (Right)—Rolled Stainless 13% Chromium Steel. Structure consists of Martensitic Matrix with embedded Ferrite Areas. Note fine Stratification providing fair Interlocking and Bending of entire layers on Edge of Pit. (Spec. No. 107, Table VI). Mag. 500 Diam.

Fig. 18, (Below)—Rolled Stainless 12% Chromium Steel. Structure consists of Coarse Grain Martensite. Note Fatigue Crack at Bottom of Pit. (Spec. No. 106, Table VI). Mag. 200 Diam.

Fig. 19, (Lower Right)—Rolled Stainless 12% Chromium Steel Structure consists of Fine Grain Martensite. Note Fatigue Crack due to Cavitation. (Spec. No. 104, Table VI). Mag. 500 Diam.

area of contact between the cloudburst balls and the surface to be treated is of macroscopic magnitude, that is, visible with the unaided eye while under cavitation, the stress application takes place over a microscopic area. At the same time the cold worked zone produced in course of cloudbursting is appreciably deeper than that caused by cavitation. Keeping in mind that cold working increases the fatigue limit as well as the hardness, it is realized that the depth of the cold worked zone must be of influence and if the increased physicals are present in a layer of greater depth than that produced by cavitation an increased resistance may be expected.

It is interesting to note that there is a definite maximum in hardness to be reached by means of cloudburst hardening. Carrying the process beyond this limit, that is, exhaust already partly the capacity of strain hardening, the Brinell decreases with a corresponding increase in loss.

3. *Welded and Sprayed Materials*

In analyzing the results of deposits built-up by means of the welding process (see Tables XI to XIV incl.) various factors must be borne in mind. In the first place the chemical compositions given refer to the wires and not to the deposits. In course of welding some percentages in alloying content may be lost. For example, the reduction in chro-

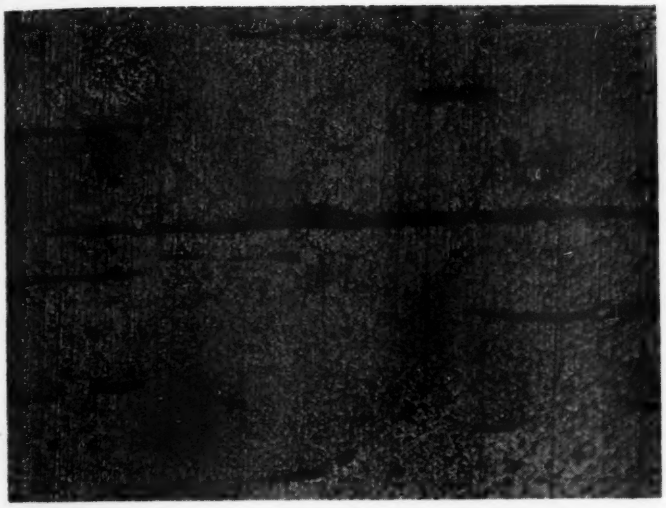

Fig. 20 (Left)—Inclusions of Sulphur in Rolled Stainless 13% Chromium Steel of Free Machining Quality. (Spec. No. 97, Table VI). Mag. 500 Diam.

Fig. 21, (Below)—Fatigue Cracks at Non-Metallic Inclusions. (Spec. No. 134, Table VIII). Mag. 500 Diam.

Fig. 22, (Lower Left)—Forged Stainless 14% Chromium Stainless Steel. Structure consists of Ferrite Matrix with Carbide Rich Areas. (Spec. No. 120, Table VII). Mag. 100 Diam.

mium content of the stainless chromium and chromium nickel steels may be as much as 1%. In the second place the chemical composition may vary with the type of coating used. Thirdly, there is the effect of the base metal. Carbon may very easily be picked up by the first layer from the base and traces may perhaps be found even in the second. That the base metal is of influence as well as the number of welded layers is demonstrated by the specimens Nos. 190 to 194, and Nos. 197 and 198 on Table XII, Nos. 223 and 224, and Nos. 227 and 228 on Table XIII.

Regarding the results in general it is noted that the stainless types showed better resistance than those of the non-stainless variety. Furthermore, the straight stainless chromium steels showed appreciably higher resistances in average than those of the stainless chromium

nickel variety. The reason for this may be the susceptibility to air hardening of the straight chromium steel deposits which is indicated by the rather high hardnesses obtained. On the other hand for some reason or other the austenitic chromium nickel steels seem to have lost part of their cold working characteristics due to the welding process. Some large losses can be noted in comparison to those of the same chemical composition in cast and rolled condition.

Attention, however, may be drawn to the fact that the cold working characteristic of the 18-8 chromium nickel variety of alloys is very sensitive to the proper proportioning of the chromium and nickel contents. Keeping in mind that small percentages of chromium and

nickel may be lost in course of welding, the composition of specimen No. 225 is likely to show a higher resistance than the specimens Nos. 220 to 223, which is borne out by the results obtained.

Based on metallurgical experience in general there are some measures by means of which the susceptibility to cold working can be improved. This can be achieved for instance with molybdenum as an alloying element, preferably 3% but even with molybdenum the correct percentages of chromium and nickel are essential (Compare Nos. 236 and 237.) A second method for improving the cold working characteristic is by lowering the chromium and nickel contents from 18-8 to 16-6 for the deposit. In addition to the improvement in the susceptibility to cold working the original hardness of the deposit is also increased by an appreciable amount, and due to the combined effect an excellent resistance can be obtained as shown by material No. 241.

A comparison between the electric arc welded specimens and those built-up by the acetylene process shows that with some of the stainless chromium steels deposited by means of the former process as high resistances were indicated as for acetylene welded stellite, usually thought of as in a class by itself.

Comparing the welded with the sprayed materials it is apparent that even the low alloyed electric arc welded deposits show far better resistances than sprayed stainless and high alloyed steels. Although spraying may have advantages in many other types of maintenance, the results as given in Table XV indicate that the spraying process may only be recommended for temporary repairs or very mild cavitation conditions.

Resistance of Materials Under Exposure to Water Jet

Since erosion due to water jet and water drops is as serious a problem for power generating equipment as pitting due to cavitation it was thought advisable to make some comparative tests to see whether or not the metallurgical aspects were similar under both types of punishment. The water jet tests were carried out at the East Pittsburgh Laboratory of the Westinghouse Electric & Manufacturing Company. The experimental unit described in detail elsewhere[22] consists of a 12 inch diameter disc rotating at high speed. Two specimens as shown in Fig. 24 can be tested simultaneously mounted on the periphery diametrically opposed to each other. There are two nozzles 180° apart directing water jets vertical to the plane of the disc so that each specimen is cutting a jet at the same time. The tests were carried out with a peripheral speed of 800 ft per sec, providing 160,000 impacts in course of the six minutes' test duration. The jet diameters were 3/32 inch and the water velocity 60 ft per sec.

In view of the experience with the cavitation test stand, where a temperature effect was indicated, it was thought advisable to investigate the possibility of a similar phenomenon under the pun-

Fig. 23—Rolled Stainless 17% Chromium Steel. Note large Grains and decided Stratification into Layers Providing Little Interlocking. (Spec. No. 98, Table VI). Mag. 100 Diam.

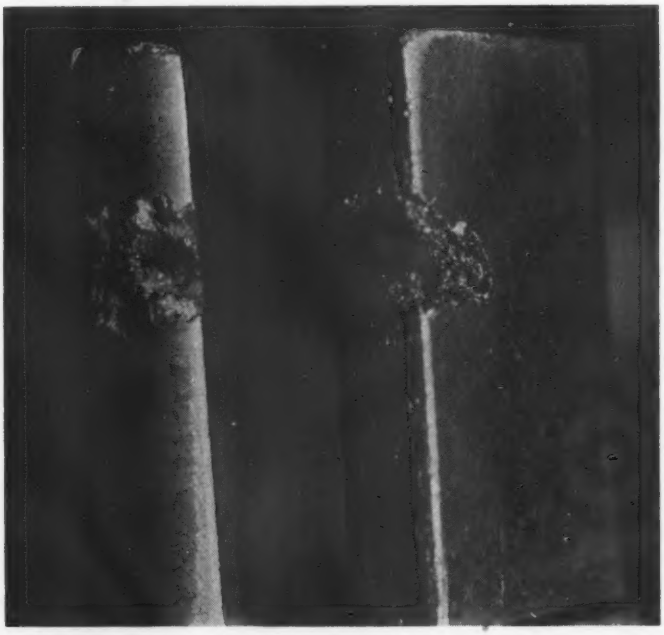

Fig. 24—Typical Specimens used for Water Jet Tests; Welded Stainless 18% Chromium Steel and Forged Wrought Iron. Mag. approximately 6 Diam.

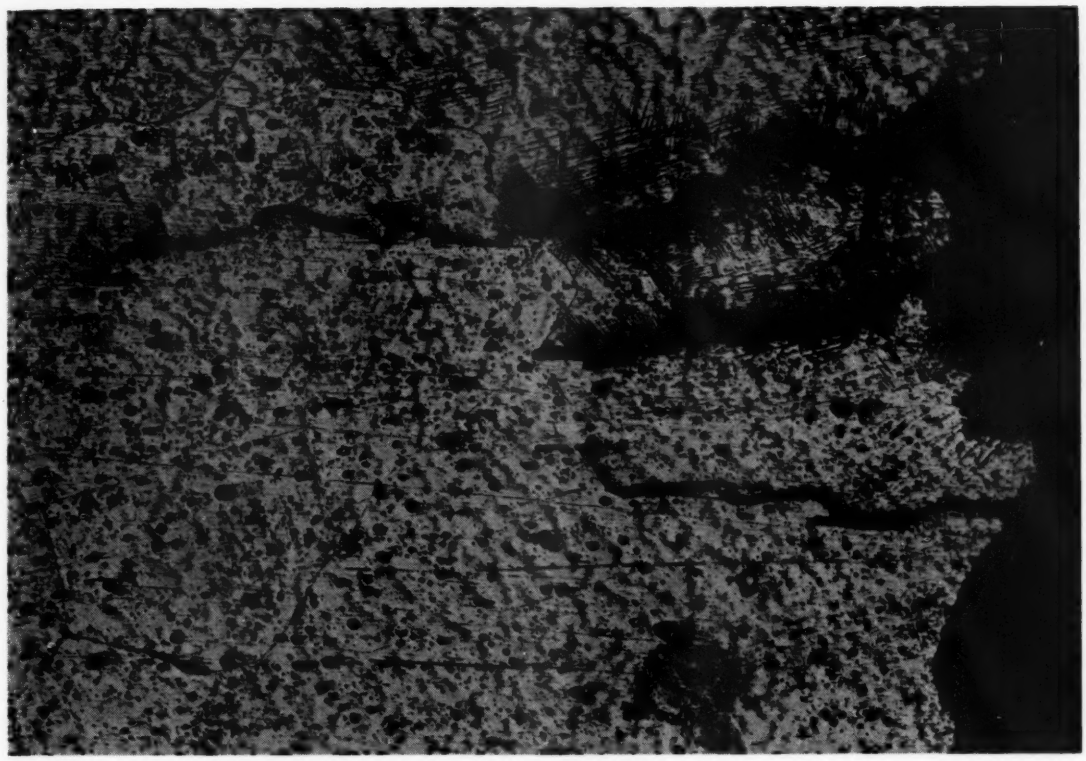

Fig. 25—Welded Stainless 18-8 Chromium Nickel Steel Pitted by Water Jet. Note Fatigue Cracks and Strain Hardening. Mag. 200 Diam.

Fig. 26—Welded Stainless 18% Chromium Steel Pitted by Water Jet. Note Fatigue and Cleavage Cracks. Mag. 200 Diam.

ishment by water jet. By gradually increasing the water temperature in successive steps from 2 to 93° C. and using the same type of materials throughout this series of runs no influence of temperature affecting the rate of pitting could be found. This is an indication that the punishment under water impact is fundamentally different from that exerted by cavitation.

In testing a considerable number of typical representatives of materials which had previously been given consideration in course of cavitation testing, it was found that the losses obtained by the water jet tests could be grouped similar to those obtained by cavitation, indicating that the various factors governing the rate of pitting resistance were to a large degree identical for both types of stress application. The microphotographic analysis of several specimens confirmed this indication.

Fig. 25 shows the work hardening of the austenitic stainless steel as may be surmised from the strain lines in the grains bordering on the surface colliding with the jet as well as those adjacent to the deep crack. Fig. 26 is of particular interest as it shows not only fatigue cracks but also separation along cleavage planes indicating that metallographic aspects are also of vital importance.

The stresses exerted by the water impact under the test conditions prevailing were far more severe than those produced by cavitation (compare Fig. 25—15) which obviously may have affected the relative importance of the individual factors influencing the resistance. It is very likely for this reason that some minor inconsistencies were found when

TABLE IX

TABLE IX. ROLLED AND EXTRUDED BRONZES AND NON-FERROUS ALLOYS

No.	Alloy	Chemical Composition - Percentage of									Condition	Typical Physical Properties					Cavitation Loss in 16 hrs. mm³ at 20°C.
		Cu	Zn	Mn	Si	Cr	Fe	Al	Mg			Tensile Strength Lbs./Sq. In.	Yield Point Lbs./Sq. In.	Elongation in 2 Inches %	Reduction of Area %	Brinell Hardness	
160	P.M.G. Metal	78.00*	2.00							e	As Rolled	85,000	60,000	30.0		123	56.4
161	Hy-ten-si Bronze No. 2	66.00	22.00	4.00			3.00	5.00		e	As Rolled	105,000	60,000	12.0	12.0	217	9.6
162	Super Strength Bronze	64.00	24.00	3.00			2.00	5.00		e	As Rolled	93,000	50,000	20.0	20.0	204	18.5
163	Aluminum Alloy No. 535M				.72	.25	.19	97.66	1.18	a	As Rolled	33,000	20,000	30.0		48	7000.0
164	Aluminum Alloy No. 175T	4.00		.50				95.00	.50	a	Extruded	58,000	35,000	20.0		109	546.0

a: Actual Analysis e: Estimated Analysis *Minimum

TABLE X

TABLE X. SURFACE TREATED MATERIALS

No.	Alloy	Chemical Composition - Percentage of												Condition	Surface Treatments	Brinell Hardness from Rockwell	Brinell Hardness from Pendulum	Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	S	Si	Ni	Cr	Mo	V	Fe	Al	Mg					
170	.20% Carbon Steel	.20	.45	.045*	.055*									e	Cast	Chapmanized	888		38.1
171	Nitralloy	.34	.53	.017	.020		.25		.20			.93		a	Forged	Nitrided	735		109.0
172	Cr V Nitralloy	.28	.55	.025	.028			1.50		.53				a	Forged	Nitrided	940		280.0
173	Aluminum Alloy No. 525 ff					.10		.26			.17	97.02	2.45	a	Rolled	Alumilite Finish	80		4200.0
174	Stainless Clad Carbon Steel	.10					8.00	18.00						e	Rolled	Clad 1/8 in. Rolled with Steel		131	11.2
175	.33% Carbon Steel	.35	.71	.032	.030	.33								a	Cast	Cloud Burst Hardened No. 2		284	43.7
176	.33% Carbon Steel	.33	.71	.032	.030	.33								a	Cast	Cloud Burst Hardened No. 3		216	51.9
177	Stainless 18-8 Cr Ni Steel	.05	.59	.025	.025	.41	8.96	18.69						a	Rolled	Cloud Burst Hardened No. 1		405	2.5
178	Stainless 18-8 Cr Ni Steel	.05	.59	.025	.025	.41	8.96	18.69						a	Rolled	Cloud Burst Hardened No. 3		405	1.4
179	Stainless 18-8 Cr Ni Steel	.05	.59	.025	.025	.41	8.96	18.69						a	Rolled	Cloud Burst Hardened No. 4		376	2.2

*Maximum a: Actual Analysis e: Estimated Analysis

Notes. No. 175 & 176 same as No. 10, Table II. (Cavitation Loss = 62.4 mm³)
No. 177-179 same as No. 108, Table VI. (Cavitation Loss = 14.6 mm³)
Cloud Burst Treatment — 1/8" ø Steel Balls, 40,000 blows per minute per sq. in.:
No. 1: 30 minutes - .50 meter fall
No. 2: 30 minutes - .30 meter fall
No. 3: 30 minutes - .50 meter fall plus 30 minutes - 1.0 meter fall
No. 4: 30 minutes - .50 meter fall plus 30 minutes - 1.0 meter fall plus 30 minutes 1.5 meter fall

TABLE XI

TABLE XI. ELECTRIC ARC WELDED LOW ALLOYED STEELS

No.	Alloy	Chemical Composition - Percentage of								Data on Coating of Electrodes and Characteristics of Deposit						Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	S	Si	Ni	Cr	Mo	Origin	Type of Deposit	Base Metal	No. of Layers	Brinell Hardness		
180	.07% Carbon Steel	.07	.33	.017	.03	.01				a	A	Normal Deposit of all Constituents	Wrought Iron	2	156	73.6
181	.08% Carbon Steel	.08	.35	.035*	.035*	.06				e	B	Normal Deposit of all Constituents	Wrought Iron	2	147	66.9
182	.13% Carbon Steel	.13	.30	.015	.03	.07				a	C	Normal Deposit of all Constituents	Wrought Iron	2	145	76.9
183	Mn Steel	.11	.39	.017	.02				.02	a	C	7-8% Mn in Deposit from Coating	Wrought Iron	2	156	39.2
184	Mo Steel	.12	.60	.035*	.035*	.08			.50	e	B	Normal Deposit of all Constituents	Wrought Iron	2	158	86.9
185	Ni Mo Steel	.08	.60	.035*	.035*	.08	2.30		.30	e	B	Normal Deposit of all Constituents	Wrought Iron	2	180	68.0
186	Cr Mo Steel	1.25	.50	.04*	.04*	.50*		5.00	1.50	e	D	Normal Deposit of all Constituents	Wrought Iron	2	258	18.6

a: Actual Analysis e: Estimated Analysis *Maximum

TABLE XII

TABLE XII. ELECTRIC ARC WELDED STAINLESS CHROMIUM STEELS

No.	Alloy	Chemical Composition of Wire - Percentage of									Data on Coating of Electrodes and Characteristics of Deposit					Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	S	Si	Ni	Cr	Mo	Cu	Origin	Type of Deposit	Base Metal	No. of Layers	Brinell Hardness	
190	Stainless 12% Cr-Ni Steel	.06	.75	.023	.022	.44	.59	12.48			a	C	Normal Deposit of all Constituents	Wrought Iron	1	287	27.6
191	Stainless 12% Cr-Ni Steel	.06	.75	.023	.022	.44	.59	12.48			a	C	Normal Deposit of all Constituents	Wrought Iron	2	310	8.4
192	Stainless 12% Cr-Ni Steel	.06	.75	.023	.022	.44	.59	12.48			a	C	Normal Deposit of all Constituents	Boiler Plate	2	319	8.1
193	Stainless 12% Cr-Ni Steel	.06	.75	.023	.022	.44	.59	12.48			a	C	Normal Deposit of all Constituents	Welded 18% Cr Steel	1	277	55.0
194	Stainless 12% Cr-Ni Steel	.06	.75	.023	.022	.44	.59	12.48			a	C	Normal Deposit of all Constituents	Welded Stainless 18-8	1	291	3.8
195	Stainless 13% Cr-Ni Steel	.06	.58	.013	.014	.74	.44	13.32			a	E	Normal Deposit of all Constituents	Wrought Iron	2	346	9.6
196	Stainless 13% Cr-Ni Steel	.07	.55	.033	.01	.61	.52	13.57			a	D	Normal Deposit of all Constituents	Wrought Iron	2	278	6.3
197	Stainless 13% Cr-Ni Mo-Cu Steel	.06	.87	.035*	.035*	.90	.70	13.58	.58	.66	a	C	Normal Deposit of all Constituents	Wrought Iron	2	295	14.3
198	Stainless 13% Cr-Ni Mo-Cu Steel	.06	.87	.035*	.035*	.90	.70	13.58	.58	.66	a	C	Normal Deposit of all Constituents	Stainless Cr Steel	1	326	7.3
199	Stainless 15% Cr-Ni Steel	.06	.39	.015	.03	.25	.10	15.55			a	D	Normal Deposit of all Constituents	Wrought Iron	2	258	7.1
200	Stainless 15% Cr-Ni Steel	.06	.36	.022	.02	.36	.09	15.73			a	C	Normal Deposit of all Constituents	Wrought Iron	2	349	8.8
201	Stainless 15% Cr-Ni Steel	.06	.36	.022	.02	.36	.09	15.73			a	C	1.25-1.50% Mn Deposit from Coating	Wrought Iron	2	366	8.8
202	Stainless 16% Cr-Ni Steel	.16	.15	.03*	.03*	.32	.78	16.45			a	C	Normal Deposit of all Constituents	Wrought Iron	2	293	5.3
203	Stainless 16% Cr-Ni Steel	.05	.33	.015	.01	.035	1.09	16.81			a	D	Normal Deposit of all Constituents	Wrought Iron	2	366	8.9
204	Stainless 17% Cr-Ni Steel	.06	.39	.04	.01	.35	1.43	17.71			a	D	Normal Deposit of all Constituents	Wrought Iron	2	390	7.8
205	Stainless 18% Cr-Ni Steel	.13	.48	.013	.013		.21	18.21			a	D	Normal Deposit of all Constituents	Wrought Iron	2	350	6.9
206	Stainless 18% Cr-Ni Steel	.13	.48	.013	.013		.21	18.21			a	D	Some Softener Removed from Coating	Wrought Iron	2	315	14.6
207	Stainless 18% Cr-Ni Steel	.13	.48	.013	.013		.21	18.21			a	D	More Softener Removed from Coating	Wrought Iron	2	309	6.8
208	Stainless 18% Cr-Ni Steel	.13	.48	.013	.013		.21	18.21			a	D	Most Softener Removed from Coating	Wrought Iron	2	304	9.1
209	Stainless 19% Cr Steel	.09	.47	.03*	.03*	.45		19.03			a	C	Normal Deposit of all Constituents	Wrought Iron	2	238	56.5
210	Stainless 19% Cr Steel	.09	.47	.03*	.03*	.45		19.03			a	C	1.25-1.50% Mn Deposit from Coating	Wrought Iron	2	285	22.7
211	Stainless 19% Cr Steel	.07	.65	.010	.01	.45	.09	19.24			a	D	Normal Deposit of all Constituents	Wrought Iron	2	222	12.7
212	Stainless 17% Cr-Cu Steel	.28			.021	.36		21.54		1.02	a	D	Normal Deposit of all Constituents	Wrought Iron	2	374	4.0
213	Stainless 23% Cr Steel	.10*	.50*	.03*	.03*	.50*		23.00			e	A	Normal Deposit of all Constituents	Wrought Iron	2	262	11.1
214	Stainless 23% Cr Ni No. Steel	.09			.01	.46	4.24	22.92	1.49		a	D	Normal Deposit of all Constituents	Wrought Iron	2	256	3.5

a: Actual Analysis e: Estimated Analysis *Maximum

TABLE XIII

TABLE XIII. ELECTRIC ARC WELDED STAINLESS CHROMIUM NICKEL STEELS

No.	Alloy	Chemical Composition of Wire - Percentage of										Data on Coating of Electrodes and Characteristics of Deposit						Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	S	Si	Ni	Cr	Mo	Ti	Cb		Origin	Type of Deposit	Base Metal	No. of Layers	Brinell Hardness	
220	Stainless 17-9 Cr Ni Steel	.09	.53	.010	.016		9.86	17.49				a	D	Normal Deposit of all Constituents	Wrought Iron	2	178	38.7
221	Stainless 17-9 Cr Ni Steel	.09	.53	.010	.016		9.86	17.49				a	D	Normal Deposit of all Constituents	Wrought Iron	2	207	26.8
222	Stainless 17-9 Cr Ni Steel	.12	.60*	.03*	.03*	.75*	8.84	17.78				a	C	Normal Deposit of all Constituents	Wrought Iron	2	206	23.4
223	Stainless 18-8 Cr Ni Steel	.07	.50	.035*	.035*	.50	8.75	18.25				e	D	Normal Deposit of all Constituents	Wrought Iron	2	218	24.6
224	Stainless 18-8 Cr Ni Steel	.07	.50	.035*	.035*	.50	8.75	18.25				e	D	Normal Deposit of all Constituents	Boiler Plate	2	230	8.2
225	Stainless 19-9 Cr Ni Steel	.05	.56	.021	.013	.39	8.30	19.45				a	C	Normal Deposit of all Constituents	Wrought Iron	2	204	13.8
226	Stainless 19-8 Cr Ni Steel	.05	.59	.023	.02	.72	8.64	19.24				a	C	Normal Deposit of all Constituents	Wrought Iron	2	222	8.5
227	Stainless 20-9 Cr Ni Steel	.05	.58	.03*	.03*	.47	9.71	20.55				a	C	Normal Deposit of all Constituents	Wrought Iron	2	188	37.1
228	Stainless 20-9 Cr Ni Steel	.05	.58	.03*	.03*	.47	9.71	20.55				a	C	Normal Deposit of all Constituents	Boiler Plate	2	192	9.8
229	Stainless 20-7 Cr Ni Steel	.06	.74	.022	.026	.50*	7.68	20.66				a	B	Normal Deposit of all Constituents	Wrought Iron	2	192	31.9
230	Stainless 27-7 Cr Ni Steel	.08	.79	.008	.006	.50*	7.86	27.88				a	F	Normal Deposit of all Constituents	Wrought Iron	2	265	17.6
231	Stainless 29-9 Cr Ni Steel	.10					9.00	29.00				e	D	Normal Deposit of all Constituents	Wrought Iron	2	260	16.5
232	Stainless 20-9 Cr Ni Mn Steel	.05	.56	.03	.03	.47	9.71	20.55				a	C	1.25-1.50% Mn Deposit from Coating	Wrought Iron	2	191	23.8
233	Stainless 21-10 Cr Ni Mn Steel	.06	1.62	.017	.01	.80	10.71	21.45				a	D	Normal Deposit of all Constituents	Wrought Iron	2	195	28.9
234	Stainless 18-9 Cr Ni Si Steel	.06	.57	.017	.015	2.30	9.45	17.98				a	C	Normal Deposit of all Constituents	Wrought Iron	2	216	12.1
235	Stainless 18-25 Cr Ni Si Steel	.05	.52	.017	.01	2.88	25.31	18.39				a	C	Normal Deposit of all Constituents	Wrought Iron	2	162	24.6
236	Stainless 18-9 Cr Ni Mo Steel	.07*	.40*	.03*	.03*	.50*	9.00	18.50	3.00			e	B	Normal Deposit of all Constituents	Wrought Iron	2	227	16.8
237	Stainless 17-10 Cr Ni Mo Steel	.06	1.38	.016	.006	.43	10.62	17.67	2.40			a	D	Normal Deposit of all Constituents	Wrought Iron	2	215	25.4
238	Stainless 19-9 Cr Ni Ti Steel	.04	.56	.022	.017	.42	9.80	19.86		.25		a	C	Normal Deposit of all Constituents	Wrought Iron	2	198	14.3
239	Stainless 17-11 Cr Ni Cb Steel	.05	.32	.004	.009	.41	11.32	17.25			.84	a	D	Normal Deposit of all Constituents	Wrought Iron	2	233	13.7
240	Stainless 20-9 Cr Ni Cb Steel	.07	.68	.024	.017	.43	9.42	20.42			.65	a	D	Normal Deposit of all Constituents	Wrought Iron	2	193	16.2
241	Stainless 17-7 Cr Ni Steel	.11	.69	.025*	.025*	.37	7.55	17.44				a	C	Normal Deposit of all Constituents	Wrought Iron	2	373	1.3

a: Actual Analysis e: Estimated Analysis * Maximum

comparing the results to the cavitation losses. For instance some of the straight chromium stainless electric arc welded specimens lost somewhat more or less than representatives of the same group with the water jet changing to some extent the order of the resistances within the group from that obtained with the cavitation test stand. On the other hand comparing the results of the straight chromium stainless steels with those of the 18-8 or 24-12 chromium nickel variety, representatives of the former group showed a decided smaller average loss than those of the latter variety, confirming entirely the results as found by the cavitation test stand.

In view of the above it is believed unnecessary to give the detailed results of this particular investigation as for all practical purposes the pitting resistances indicated by the cavitation tests given on Tables I to XV may also serve as a guide when selecting materials to be exposed to the punishment by water jets or water drops taking place on impulse turbines and the low pressure stages of steam turbines respectively.

TABLE XIV

TABLE XIV. ACETYLENE WELDED MATERIALS

No.	Alloy	Chemical Composition - Percentage of											Data on Deposit			Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	Si	Cr	W	Sn	Cu	Zn	Co		Base Metal	No. of Layers	Brinell Hardness	
250	Tobin Bronze							.75	60.00	39.25		e	Wrought Iron	2	81	386.0
251	Everdur		1.10		3.50				95.40			e	Wrought Iron	2	58	599.0
252	Phosphor Copper Bronze			7.50					92.50			e	Wrought Iron	2	137	1370.0
253	DX - Bronze												Wrought Iron	2	88	540.0
254	Stellite "6"												Wrought Iron	2	550	10.8
255	Stellite	1.00				30.00	4.00				65.00	e	Wrought Iron	2	346	6.3
256	Stellite	1.10*				30.00	8.00				60.00	e	Wrought Iron	2	351	3.4
257	Stellite	1.10*				30.00	15.50				50.00	e	Wrought Iron	2	394	3.9
258	High Carbon Cr-Mn Steel	1.10*	3.50			15.00*						e	Wrought Iron	2	258	12.4
259	Mn Bronze												Wrought Iron	2	115	300.0

e: Estimated Analysis * Maximum * Minimum

TABLE XV

TABLE XV. SPRAYED MATERIALS

No.	Alloy	Chemical Composition of Wire - Percentage of											Data on Deposit			Cavitation Loss in 16 hrs. mm³ at 20°C.
		C	Mn	P	S	Si	Ni	Cr	Fe	Sn	Cu	Zn		Depth of Deposit - in.	Brinell Hardness	
260	.10% Carbon Steel	.10	.50	.06*	.05*	.02*							e	.25	181	561.0
261	.85% Carbon Steel	.85	.44	.025	.032	.17							a	.25	266	350.0
262	Stainless 13% Cr Steel	.45*	.43*	.015*	.016*	.32*		13.50*					e	.25	269	185.0
263	Stainless 18-8 Cr-Ni Steel	.06*	.62*	.022*	.022*	.37*	9.25*	21.20*					e	.25	181	207.0
264	Stainless 15%Cr-62%Ni Steel	.20	.20			.35*	62.00	15.00					e	.25	172	275.0
265	Monel	.20	1.00			.10*	68.00		1.50		29.00		e	.25	115	477.0
266	Tobin Bronze									.75	60.00	39.25	e	.25	79	2090.0

a: Actual Analysis e: Estimated Analysis * Maximum

Conclusions

In view of the comparative data on the pitting resistance of many alloys made available by this research, it is believed that the selection of materials for new installations and maintenance of present equipment exposed to cavitation would appear to be on a more rational basis in the future. However, attention should be drawn to the fact that the data presented are necessarily limited in that certain alloy compositions were not tested in the most suitable stage of physicals and grain structures to be attained. At the same time many materials could not be given consideration in course of the testing program. Nevertheless, since this research broadened the metallurgical aspects of pitting to such an extent as to permit various deductions regarding the effects influencing the resistance, it may be realized that the physicals and grain structures in castings, rolled sections, forgings or welding deposits may be predicted sufficiently close under modern manufacturing procedures for almost any alloy to arrive at some conclusions regarding the performance to be expected in the field.

It is also of importance to bear in mind that in the light of past experience there appear to be in many instances definite limitations to the possibility of pitting. The fact that even the most resistant materials have suffered an actual loss under the accelerated test conditions should not lead to the assumption that any material would necessarily break down sooner or later in the field. To the contrary experience gained on

past installations may serve as a guide to good advantage. For instance, at Safe Harbor and Holtwood where considerable pitting could be observed on cast steel and cast iron turbine blading respectively, no loss in material has occurred on the areas welded in the field with suitable stainless steels.

It is evident that aside from the pitting resistance, the choice of the material is also influenced by the manufacturing procedures and economical considerations. Since material costs may not always be of minor importance in comparison with the losses incurred by outages required for maintenance or losses caused by impaired efficiencies due to pitting, all factors must be carefully weighed to the best advantage. In case special alloys of high resistance are justified heat treatments should be given careful consideration. It would be wasteful to make high expenditures for the material and then use it in annealed condition except in the case of alloys showing excellent cold working characteristics.

It should also be borne in mind that manufacturing procedures may set definite limitations in the physicals and heat treatments may have to be carried out in such a way as to suit production. For instance in case machining is thought essential the hardness must be kept within reasonable limits. This may lead to difficulties where subsequent heat treatment cannot be carried out due to warpage and a 12 to 14% stainless chromium steel must be given preference due to economical considerations over an austenitic stainless chromium nickel steel of the 18-8 or 24-12 variety. If such a condition were to arise, for instance with propeller blades, it may almost be a matter of personal opinion as the advantage gained by machining may appear outweighed by the increased resistance to be attained by heat treatment or alloying elements producing physicals in excess of those required for machining. As in many other fields of engineering, each contributing factor must be carefully considered to best satisfy all requirements concerning the manufacture, operation and maintenance.

Acknowledgments

This research was made possible through the support received from J. A. Walls, President, Safe Harbor Water Power Corporation. The interest shown by the Research and Metallurgical Departments of the steel and alloy manufacturers, too numerous to mention individually, is greatly appreciated. It is realized that without their cooperation this research would have been prohibitive.

At the same time the author is indebted to Mr. H. N. Boetcher (26.27), Assistant to Superintendent of Steam Stations, Consolidated Gas, Electric Light and Power Company, Baltimore, Md., for his contributions to the metallographic phase of this research.

Trouble Analysis and Power System Economies

(*Continued from page* 419)

duration of such cessation in minutes or hours.

7. *Outages*

"Outage" is the measure of the seriousness of an interruption through its inclusion of the factor of capacity affected. Primary distribution system outage is expressed in connected transformer kva-hr, that is, plant capacity affected x duration of interruption. Secondary distribution system outage is expressed in customer service-hours or connected transformer kva-hr if conversion data are available.

8. *Failure or Breakdown*

"Failure or Breakdown" is a trouble which takes place while the apparatus is in operation.

9. *Fault*

"Fault" is the affected portion of apparatus which has experienced trouble.

B. Definitions Under "Cause of Trouble"

10. *"Natural Conditions"* includes causes of trouble resulting from abnormal weather or other conditions of environment, such as lightning, wind and rain, snow and sleet, extreme cold, erosion or motion of earth.

11. *"Foreign Agencies"* includes all non-inherent causes of trouble other than "Natural Conditions," originating outside of the control of the Company, such as interference by public, animals, and other companies.

12. *"Other Interference"* is a subdivision of "Foreign Agencies" which includes damages effected by private contractors, hunters, children, and other foreign agencies not definitely specified previously.

13. *"System Inadequacy"* includes those causes of trouble which are due to obsolete or poorly designed plant equipment of field construction, inadequate plant, or inadequate maintenance as judged by existing practice.

14. *"Obsolescence or Poor Design"* includes those causes of trouble to equipment or plant which are due to obsolete design features or methods of construction which are considered so unsatisfactory that, once removed from the system for any reason, they would not be returned or reapplied to the system unless the unsatisfactory conditions were modified. This heading also includes causes of trouble to equipment or plant which are due to poor design of equipment or poor field construction methods.

15. *"Inadequate Plant"* includes causes of trouble resulting from lack of plant equipment which it is the existing practice of the company to use. (Example: Protective equipment planned but not yet appropriated.)

16. *"Inadequate Maintenance"* includes causes of trouble due to failure to make inspections, repairs and replacements according to recognized schedules; or due to delay beyond reasonable time in replacement following condemnation following regular inspection.

17. *"Defective Equipment"* includes causes of trouble due to defects in manufacture or to normal or premature deterioration of equipment.

18. *"Personnel Failure"* includes causes of trouble due to mistakes or negligence on the part of supervisors or employees, such as careless or intentional violation of instructions, misreading of data, poor manipulation of tools or equipment, poor execution of construction of installation work, omissions or errors in judgment during inspection as evidenced by failures between normal inspection intervals; and other such mistakes as are clearly assignable to a particular person. (Note: This does not include poor engineering judgment in the design of equipment or the planning of construction.)

C. Definitions Under "Evidences of Trouble"

19. *"Circuits: Failure of Supply"* is an evidence heading provided for the entry of failures of the electrical supply system up to and including the distribution circuit bus.

20. *"Circuits: Station Trouble"* is an evidence heading provided for the entry of troubles located definitely on distribution circuit equipment between and including the connections to the distribution bus in the station and the point of exit of the circuits from the station.

21. *"Circuits: Circuit Trouble (No Other Evidence)"* is an evidence heading provided for the entry of troubles of which there is *no other evidence*, but one or more breaker operations, or sections out. Several breaker operations on the same or closely related circuits which are assumed to be the result of the same cause and occur within a period not exceeding 24 hours, are treated collectively as a single evidence, and as such, are entered as a single trouble.

(*Continued on page* 440)

Prize Awards in the Electric Cooking Field Offered by Three Donors

R. B. MARSHALL AWARD

Further stimulation of the electric cooking load will be given with the announcement of the R. B. Marshall Award. The award is $500 to be distributed in cash prizes of $100 each to the operating utility retail salesman who sells, leases or rents for his company during the year 1938 the greatest number of domestic electric ranges of a rated capacity of seven kilowatts or more to individual homes.

R. B. MARSHALL

The purpose is to promote greater activity and efficiency among utility retail salesmen. Consideration will be given to the over-all qualifications of the individual and his ability to retain good will of customers and other dealers.

The Award has been accepted by the Prize Awards Committee of Edison Electric Institute of which Mr. H. P. Liversidge of Philadelphia Electric Company is Chairman.

The period of the contest will start on Jan. 1, 1938, and continue for the calendar year. Prizes will be awarded at the Annual Convention of the Institute in 1939.

A. L. LINDEMANN AWARD

Mr. A. L. Lindemann, President of A. J. Lindemann & Hoverson Company, has renewed his offer of $300 for three cash prizes for the most meritorious papers by employees of electric light and power companies dealing with the advantages of electric cookery. The exact subject assigned for the essays is The Advantages of Electric Cookery for Domestic Purposes.

In determining the merits of the essays, the prime factors are quality and interest of the subject matter, originality in method of presentation and clarity of statement. This has been one of the very popular contest features during the past three years. It was of unusual interest that during the 1936 contest all three prizes were won by the male sex.

GEORGE A. HUGHES AWARD

Again this year the Hughes Award is offered through the courtesy of the donor, Mr. George A. Hughes, President of Edison General Electric Appliance Company. This prize of $1,000 is given for the advancement of electric range sales during 1937. It is a Company prize for "the operating utility, and individuals in the Company, whose work and co-operative efforts show the greatest contribution to the development of the domestic cooking load, through promotion, or selling, or both, during the calendar year 1937."

GEO. A. HUGHES

A Cup is given to the Company. One thousand dollars in cash is divided, $500 to the Commercial or Merchandising Executive of the winning Company, and $500 to be divided among the retail sales directors and retail salesmen in proportion to the way they have contributed to the Company activity in the promotion of electric range sales. Recognizing that some companies do not sell electric ranges, provision is made that if a competing Company does not sell, the $500 may be distributed at the discretion of the Commercial Executive, either to members of his Department working with outside agencies or to the agencies themselves.

The Hughes Award being based in part on *number* of electric ranges sold per thousand customers, and on percentage increase saturation, requires registration by contestants of the number of domestic meters serving family units and the number of electric ranges connected to the Company's lines as of Jan. 1, 1937.

Further details in connection with these Awards may be received by addressing the Commercial Department, Edison Electric Institute, 420 Lexington Avenue, New York City. All utility companies and individuals in utility companies, irrespective of membership in the Institute, who are interested in the promotion of the electric cooking load are cordially invited to enter these competitions.

Maryland Association Convention

OFFERING a program of general interest to all phases of utility operations, the Maryland Utilities Association met at the George Washington Hotel, Ocean City, Maryland, Sept. 10-11. At the business session John B. Battle, executive secretary of the National Coal Association, discussed the government program of "yardstick" projects and pointed out where the coal mining industry was endangered by subsidized hydro-electric developments.

Herman W. Boozer, general auditor of the Georgia Power Company, discussed the problems faced by management and the accountant under the new classification of accounts. He particularly asked concerning the relationship between accounting values as set up for security, rate-making, and valuation purposes particularly with reference to their interpretation by state and federal regulatory bodies.

In discussing the future in utility merchandising, with particular stress on gas appliances, J. P. Haftenkamp, vice-president of the Rochester Gas and Electric Corporation, presented some interesting facts to show that the public is not as well acquainted with utility electric service as they might be. He urged a closer study of physical and psychological changes such as living habits in order to gear merchandising technique to current thinking on the part of the customer. The data from surveys which he quoted revealed interesting and valuable material pertinent to sales planning.

The remainder of the week-end was given over to social functions. D. E. Stultz, vice-president of the Potomac Edison Company, Hagerstown, Maryland, is president of the Association, R. C. Brehaut, Washington Suburban Gas Company having had direct charge of the arrangements for the meeting.

Meetings of Electrical Equipment Committee and Transmission and Distribution Committee

J. F. Fairman and H. P. Seelye, Chairmen Respectively

THE fall meeting of the Electrical Equipment Committee and Transmission and Distribution Committee was held at Cleveland, Ohio, Oct. 11-13. The meeting on Monday was of the Electrical Equipment Committee, on Tuesday a Joint meeting of the two committees, and on Wednesday the Transmission and Distribution Committee meeting. Attending the meeting of the Electrical Equipment Committee were thirty members, and the Transmission and Distribution Committee had thirty-five of its members present. In addition, about forty-five visitors were present at these meetings.

The Monday morning session was a closed session of the Electrical Equipment Committee where items of procedure and the plans of the committee were reviewed. The report on Apparatus and System Failures was presented and a number of the outstanding items of this report were reviewed. In addition, a paper giving the results of tests of various methods of extinguishing oil fires was discussed by the committee.

The System Engineering Division under Mr. Hentz presented two papers, —the first dealing with Investment, Operating and Maintenance Problems, by Mr. E. S. Fitz, and the second a paper on Load Forecasting—Some Change Conditions, by Mr. W. M. Carpenter. These papers pointed out the necessity for careful consideration of the present-day conditions and also of changes in trends of conditions when considering additional capital expenditures to carry electric and utility load.

Mr. Newton, Chairman of the Rate Research Committee of the Institute, presented a paper on Rates for Electric Water Heating. Mr. Newton's paper points out that in order to *profitably* serve the water heating load consideration must be taken of the effect of this load on every part of the electric system and that it must not be treated merely as incremental load without any investment charges for the system which is utilized or which may even require expansion to serve it. Mr. Newton also pointed out that the competition for range and water heating load was increasing.

Papers on testing of generator insulation windings were presented by Messrs. Webb and Van Ness. Practically no information has been available to determine the proper tests to be conducted on generators which have been in service for some time to determine the condition of the insulators. Opportunity has been taken of the retirement from service of a number of old generators to test these windings to destruction. The work so far done has brought out many interesting factors relating to the condition of generator insulation varying in age from ten to thirty years. As yet this work has not progressed far enough to develop definite standards of tests.

Mr. Silver presented the report of Mr. Allen, Chairman of the Meter Subcommittee, outlining briefly the recent accomplishments of this subcommittee. The subcommittee has canvassed very carefully the special or unusual requirements of utilities imposed upon manufacturers with a view to eliminating, as far as practical, the special requirements so as to be able to further reduce the cost of meters. In April, 1937, the price of the 15 ampere single phase meter was reduced to the former price of the 10 ampere meter. Characteristics of the new 15 ampere meter are such that it is expected that the 10 ampere meter will be eliminated in the future.

At the Joint Session of the two committees Messrs. R. E. Dennis, A. A. Lipschutz, Geo. Vessellago, and J. H. Lobban, pesented a symposium on continuing property records. These papers showed the part that the engineer should play in the setting up and maintaining of continuing property records and showed the necessity for full cooperation between the engineer and the accountant in this work.

Mr. A. M. McCutcheon, Past President of the AIEE, addressed a joint luncheon meeting of the committees. Mr. McCutcheon, in his address, presented an interesting picture of the activities of the local and national engineering societies showing the need for better cooperation in engineering activities.

Mr. Eugene Vinet gave an interesting talk, accompanied by numerous lantern slides, on Why Electric Water Heating Requires Distribution Expenditures. The effects on distribution systems and generating capacity due to combined range and water heating loads were illustrated. This also included a discussion of the methods whereby these two types of loads may be served to avoid cumulative peak-loads on the distribution system.

Mr. Fitch presented a report on Rehabilitation of Flood Damaged Equipment. This was a compilation of the experiences of the various utilities whose property was damaged by flood a year or two years ago. It is planned to revise the report to include other experiences and print it so that a compilation of the experiences of the various utilities will be available in any future situation.

A paper by Mr. S. N. Humphry presented the problems of electric welding and showed the characteristics of this load on the electric system.

The second day of the Transmission and Distribution Committee meeting was held on Wednesday, October 13. As this was the first meeting of the Committee under the administration of Mr. H. P. Seelye, some time was devoted to a description of the committee organization and an explanation given of some changes that had been made in group and subcommittee organization and scope.

The only paper presented during the forenoon session was by Mr. H. O. Sprinkle. This was on the subject, Characteristics of Electric Range Load are Improving. This dealt with the improvement observed with increased saturation of ranges and improvement in their design. Mention was made of the various factors which affect range loads, such as shorter working hours, community characteristics, and meal and cooking habits in various kinds of localities.

Mr. Davidson presented a report on the 1936 Cable Operation Report. This report follows the form of those presented each year for the past several years and affords an opportunity for comparing the operation of the cable in 1936 with the operation in preceding years. A discussion followed the presentation of the report in which some attempted to explain certain of the dif-

ferences in operation as shown by the 1936 data as compared with comparable items in preceding years.

During the afternoon session, a paper was presented by Mr. O. V. Gatchell, Chief Engineer of the Copper Wire Engineering Association. This was on the subject, Sags, Tensions and Characteristics of Overhead Conductors Produced in the Copper Wire Industry. This paper dealt with a subject that has been under consideration and study by this committee for several years and which is of special interest at the present time, viz., the performance of hard drawn copper and copper-weld conductors in long-span rural lines. The results of the work which Mr. Gatchell described will be looked forward to with considerable interest by many interested in this subject.

A progress report was made by Mr. Davidson, Sponsor of the Plant Coordination Group. This included brief accounts of some of the current problems which require coordination with the physical plant and facilities of other industries.

Mr. Sayles, Sponsor of the Standards and Specifications Group, presided while reports were made on several subjects relating to standardization. These included Timber Products, Insulators, Distribution Fuses, Hard Drawn Copper Transmission Cable and Pole Line Hardware. Suggestions for Specifications for Bolts and Nuts, TD-1, 1937, Low and Medium Voltage Pin Type Insulators, TD-51, 1937, and Insulators and Pin Threads and Gauges, TD-71, 1937, which had just been published, were presented and distributed to the committee.

Group sessions were held during the latter part of the forenoon session, during which time a meeting of the Underground Methods and Accessories Subcommittee of the Underground Group held a meeting which continued throughout the remainder of the day. In addition to discussing several subjects of current interest in a Round Table Session manner, this subcommittee made tentative plans for carrying on its work throughout the coming year.

The Electrical Equipment Committee is planning to hold its second meeting of the year at the Netherland Plaza Hotel in Cincinnati on February 7 and 8.

The Transmission and Distribution Committee is planning to hold its second meeting of the year at the Brown Hotel in Louisville, Kentucky, on February 9 and 10.

Accident Prevention Committee Meeting

L. M. Shadgett, Chairman

THE Fall Meeting of the Accident Prevention Committee was held at the Cleveland Hotel, Cleveland, Ohio, Oct. 9. This was a one-day meeting and was held at this time in order that those who were planning to do so might also attend the Annual Congress of the National Safety Council in Kansas City the following week. By holding this meeting at this time and in this location it was also possible for some of the members to remain until the first of the following week to attend the meetings of the Electrical Equipment Committee and the Transmission and Distribution Committee, both of which were scheduled to be held at that time at the same hotel.

This was the first meeting presided over by the new Chairman, Mr. L. M. Shadgett, Division Manager of the Georgia Power Company, Athens, Georgia. Mr. Shadgett succeeds Mr. W. A. Buchanan, District Manager of the Appalachian Electric Power Company at Welch, West Virginia, who has been Chairman of the committee since it was organized in 1934.

This committee has 17 members, geographically distributed throughout the country. All but five of the members were present and in addition several visitors and guests attended, some of whom were scheduled to participate in the discussion scheduled for this meeting.

Rubber Protective Equipment for Linemen: This subject is one which has engaged the attention of this Committee since shortly after the committee was organized and by the predecessor committee of the NELA. However, most of the attention so far has been given to a consideration and study of rubber gloves for linemen. Recently linemen of some of the companies have reported that leakage has been felt during wet weather when protective rubber hose and insulator shields were used. It developed that a somewhat similar situation existed with regard to insulator hoods, although this is a somewhat different problem and will be studied later.

It was explained that although leakage had been reported there are no records of fatal or injurious shocks due to a failure of the rubber hose. Thus far, workmen have experienced only physical inconvenience at times when working with line hose during wet weather. The hazard is serious because leakage may be enough to cause a fall or muscular reaction resulting in contact with lines. Sufficient study and investigation have not been conducted to warrant conclusions. Several of the larger companies are greatly interested in this subject, and a definite test and investigation procedure have been developed whereby laboratories of various companies can conduct tests that can be compared.

There was present during this discussion a representative of one of the largest manufacturers of linemen's protective hose who contributed a valuable discussion on this subject. It was decided that this committee will sponsor further investigation and research to produce reliable data.

Rubber Gloves: The committee has been studying this subject for many years. With the increased use of higher distribution voltages particularly in rural electrification, the need for maintaining these circuits while energized is a problem that requires consideration. The type of rubber glove on the market at present is not intended for use on circuits or apparatus where the gloves must withstand voltages exceeding 3000 volts to ground. Safety features should not be sacrificed in attempting to meet new developments. Some means should be provided for safe maintenance of distribution circuits when voltages exceed 3000 volts to ground without resorting to hot line tools. It was brought out in

this discussion that the experimental work which has been carried on in a number of laboratories indicates that it is not practical with existing materials to make a rubber glove that can be considered safe under all conditions of use on circuits of more than 3000 volts to ground when the glove is depended upon solely for the workmen's protection. The committee plans to study the problem to determine what auxiliary equipment is needed or available to supplement rubber gloves in order that maintenance may be performed safely.

This is a problem in which the Transmission and Distribution Committee is interested and any work which the Accident Prevention Committee does should be coordinated with the ideas of the Transmission and Distribution Committee. It was voted to reaffirm this committee's previous action regarding the use of rubber gloves purchased under A.S.T.M. Specification D-120-23 and that this committee cooperate with the Transmission and Distribution Committee in developing means of working on the higher distribution voltage circuits while energized. It was also decided that Dr. Skinker who is sponsor of this subject in this committee be requested to get in touch with the appropriate A.S.T.M. Committee and ascertain if any revision of voltage limits of existing rubber glove specifications is planned. This is to be reported upon at the next meeting.

Electric Fences: This subject is creating much interest at the present time. Although this committee has been studying the development of electrifying farm fencing through control devices for the past two years, other committees have become interested recently in the subject due to the wide-spread use of the practice. The subject was discussed at a joint meeting of the Electrical Equipment and Transmission and Distribution Committees on Oct. 12.

Mr. H. J. Burton who is sponsor of Public Safety in the Accident Prevention Committee has been in touch with the development throughout the various sections of the country. Since the attention of this committee was drawn to this subject about two years ago, the use of equipment for energizing fences has increased rapidly due to the savings that can be realized in the cost of farm fencing.

Due to the fact that there have been a number of fatalities with poorly designed, installed or maintained devices or where a direct connection has been made to a power circuit, the hazards involved should be brought to the attention of the farm public. Mr. Burton explained that there is on the market a successful device that energizes a fence from a six-volt battery and that this is generally considered as having a great deal less hazard than those energized from power circuits. A principle which this committee has followed and which is supported by physicians, engineers, and other qualified persons, is that electric current should not be intentionally passed through the human body except under conditions controlled by qualified physicians. So far the committee has no knowledge of a fatality on fences energized through controlling devices now on the market while these devices remained in good operating condition. Such devices may become inoperative and if this occurs, it is feared that a temporary connection will be made directly to a power circuit, producing a hazardous condition. In many sections of the country power companies have discouraged the use of power circuits for energizing farm fences, although in other sections, some companies feel that this is an economy and convenience to the farmer which he should have.

Some states have approved, under certain restrictions, some of the fence energizing devices that are on the market. Also some of the Agricultural Colleges have approved such devices. In some instances both the power-operated and battery type units have been approved by these institutions. The committee will continue to follow this subject and make available such information as may be obtained.

Employee Health: Mr. Wills Maclachlan reported that progress had been made since the last meeting in developing a program for employee health. A sub-committee consisting mostly of company physicians is studying this subject. It was explained that the lost time due to employee health is so important that all companies should become interested. Mr. Maclachlan said that as a result of study and investigation thus far it had been decided to publish in the EDISON ELECTRIC INSTITUTE BULLETIN, beginning about next January, a series of six or seven articles which will deal with the various phases of this general subject. These articles will be written by physicians or by other qualified persons associated with operating companies and will be based on experience obtained in their respective companies. He said that in response to a communication sent from the General Office a few months ago to member company executives, that he has received the names of the company physician or doctor for a number of companies. He has communicated with these with a view to obtaining their experience. The smaller companies who do not engage a physician for employee health need the benefit of the experience of those who handle this problem through a company physician.

Accident Statistics: Mr. C. R. Beardsley of the Brooklyn Edison Co., has been sponsor of this subject since the committee was organized. He reported that the final statistics for 1936, as well as those for 1935 have now become available and that the 1936 trend in days lost, lost-time accidents and fatalities showed a substantial increase over 1935. The reason for these increases cannot be determined until the 1936 data on Cause and Locus are at hand.

The Chairman said that this report was of great importance and that it indicates that continued and increased attention must be given to safe working conditions and accident prevention with a view to reestablishing the downward trend in employees accident records. He urged all members of the committee to exert every possible effort toward this end and asked for full and complete cooperation with Mr. Beardsley in obtaining the necessary data whereby this subject can be given careful study. It was decided that Mr. Beardsley would prepare a discussion on this subject for publication in the Bulletin.

Traffic Hazards: Mr. C. N. Rakeshaw of the Cleveland Electric Illuminating Company, sponsor of this subject, pointed out that our main concern is with the reduction of traffic accidents by company drivers and employees, although anything which can be done to improve the traffic accident record in general should be encouraged and we should cooperate to this end in every way possible. Mr. Rakeshaw called attention to an interesting article that appeared in the National Safety News for August of 1937, entitled "The Most Important Driving Sense," by P. E. Howell, Safety Engineer, Firemen's Indemnity Co. of San Francisco.

Attention was called to a statement of a state motor vehicle department to the effect that they had found an unexpected large percentage of people visually unfit to operate a car and that their progress on the highway is one hair-breadth escape after another. It was believed that it is the inability to

perceive until it is too late, that causes many accidents. An interesting point brought out in this article was that there are several features with regard to vision which are likely to influence safe driving, although it had been found, after a careful analysis of much data and information, that some drivers who are greatly deficient in vision appear to have good driving records. This is attributed to the fact that if the driver is aware that he has deficient vision he compensates for this deficiency by observing extra precautions. The most dangerous type of driver is the one who is unaware of his infirmity and attempts to drive normally.

Following Mr. Rakeshaw's report, he introduced a representative of the Keystone View Co. of Meadville, Pa., who gave a demonstration with equipment which had been developed for testing vision. These tests can be made by laymen and will provide a ready method for determining how well equipped an individual's eyes are to do important daily tasks efficiently and safely. It was thought especially desirable to have the test applied to the drivers of company vehicles to determine if defective vision exists. Good vision is important in all work. Tests will reveal deficient vision of employees which can be easily and quickly corrected. The representative who made this demonstration explained that they do not attempt to diagnose or analyze the results of the tests but merely examine and test for vision, report the findings, and then recommend that the person consult a qualified specialist for advice of any corrective measures necessary.

Holdoff Methods: This subject was reported upon by Mr. Beardsley for Mr. Gross who was unable to be present. Mr. Beardsley explained that not much progress has been made during the past year. A discussion with representatives of the Electrical Equipment Committee was held and it was decided to proceed with the subject. The subcommittee of the Accident Prevention Committee will be headed by Mr. D. C. Stewart. The Electrical Equipment Committee will cooperate with the expectation that the Accident Prevention Committee will assume the lead in preparing a statement of objectives and means of accomplishment.

Office Hazards: Mr. E. R. Kropp of the Union Electric Company of Missouri, sponsor of this subject, was unable to be present. He had submitted a report in which he said that most phases of this subject needing attention are being studied and reported on by the National Safety Council. Considerable study of the various types of office hazards had been made and there appears to be no need to supplement this with a special study for power companies. Mr. Kropp, in accordance with instructions of the committee at a previous meeting had been in touch with the Insurance Committee of the Edison Electric Institute and it was found that two or three items which they are studying might be of interest to the Accident Prevention Committee. When complete reports are available on these subjects, Mr. Kropp will bring these to the attention of this committee.

The Use of CO_2 Equipment in Fire Extinguishers: Mr. George Diehl of the Penna. Water & Power Company is sponsor of this subject, and reported that this problem is largely concerned with portable equipment. He had found considerable interest on the part of some companies of the portable equipment hazards under certain conditions. Although not much has been published on the subject, when the problem was brought before the committee it developed that several companies had had some unsatisfactory experience. Mr. Diehl was of the opinion that this problem needs to be worked out with the manufacturers of the equipment, and the committee decided that he should continue his study and cooperate with the various manufacturers concerned.

Resuscitation: It was explained that the booklet on Resuscitation, NELA Publication 289-70, which had been out of print, had now been reprinted and was available for purchase. This booklet gives the technique of Resuscitation from electric shock, drowning, and asphyxiation, and was jointly prepared by a large number of interested organizations. It may be obtained through the Edison Electric Institute, General Office.

Low Voltage Hazards: Mr. E. W. Gorry, Sponsor, was unable to be present. It was explained that the leaflet entitled "Your Unseen Helper" had been available for the last several months and that something in the order of one million copies had been sold. Several companies indicated an interest in purchasing this leaflet and distributing it to customers as an educational effort to avoid shock on low voltage and utilization circuits. It is intended primarily for use in pointing out the precautions necessary in the home to avoid electric shock.

Several progress reports were made by those who have been designated as contact representatives with other E.E.I. committees. All of these indicated that there is much to be accomplished through cooperating with the other committees and in making the information which this committee obtains available to the membership of these committees. Consideration of safety in the work of other committees is essential to this committee in properly carrying on effective accident prevention work.

There was a brief discussion with regard to some of the publications that are being prepared by the National Safety Council that is of interest to this committee. It was pointed out that we had been cooperating with the National Safety Council in reviewing the advance texts of several of its publications and safe practices pamphlets, and that this should be continued with a view to having these publications consistent with operating practice and suitable for practical use within the industry.

Mr. W. A. Buchanan, the retiring Chairman, served this committee since it was formed under the Edison Electric Institute. The committee unanimously passed a resolution of appreciation for the services which Mr. Buchanan had contributed and his personal sacrifices in making the work of this committee a success. The present status of the committee's activities are largely due to the enthusiasm and the support which Mr. Buchanan has given to the committee's work and the committee expressed to Mr. Buchanan a debt of gratitude for the excellent work done under his administration.

Light in the Schoolroom

(*Continued from page* 422)

from an eye that has previously been hyperopic.

Justice requires something more than good light in the schoolroom. But it cannot be done without adequate light for all the children. And this cannot be attained until teachers and parents and pupils understand what is good light and its great importance at all times. When all of these have mastered this essential, school authorities, school architects and school financiers still have to be educated to know that good lighting and justice are worth having in any community.

Prime Movers Committee Meeting

W. E. Caldwell, Chairman

THE first meeting of the current administrative year of the Prime Movers Committee was held October 1, 2, at Purdue University, Lafayette, Ind. The principal business of the meeting was to outline the work of the Subcommittees and discuss topics for treatment during the year.

Mr. Fellows of the Chemistry Subcommittee discussed the status of the embrittlement investigations being sponsored by member companies on which papers will be presented at the ASME Annual Meeting in December. The work of the Metallurgical Section of the Committee relating to the metallurgy of pipe and castings as well as other functions of the Section was discussed by Mr. Boetcher. For the Chemistry Subcommittee Report, subjects mentioned for consideration were: summary of feedwater treatment practices; the study of colloidal treatment; the effect of chlorination on corrosion; settlement of phosphate sludge and available information on feedwater research. Professor Straub reported that at temperatures below 570 deg. there appears to be no decomposition of sodium sulphite.

Mr. Baker, in outlining the proposed work of the Boilers Subcommittee, described the subjects under consideration, including experience with the newer boilers; starting-up procedure; performance of steam washers; continuation of availability data and related items.

Mr. Muir, in discussing topics for consideration by the Combustion Subcommittee, stated that furnaces are to be an important feature of the Report on account of the radical design changes in recent installations. Other subjects described were: performance of the new water-cooled stokers; experience with new types of pulverizing equipment; oil and gas firing and combustion experience with new installations about to be placed in service.

Mr. Drabelle stated that not much new material appears to be available for the Oil and Gas Engines Subcommittee at this time but information would be sought which might be of interest to the membership.

Mr. Crofts for the Turbines Subcommittee described suggestions received for discussion in addition to the usual turbine availability data presented in the Report. Among the suggestions were: frequency of inspecting turbine units; pressure reduction and desuperheating; heater experience and information on the operation of the new high pressure units.

There was a discussion on boiler insurance practices, classifications and ratings for the purpose of obtaining opinions to assist the Insurance Committee and insurance companies in modernizing their method of rating the newer boilers. Changes in the older methods of determining size or capacity appear to be necessary, due to radical design changes in boiler equipment which have taken place since the present insurance tables were established. At present, ratings are established on the basis of primary heating surface plus a certain proportionate allowance for water walls; this practice was adopted, with the concurrence of the Prime Movers Committee, shortly after the use of water walls became common practice. At present, due to the changed distribution of total heating surface between water walls, main boiler, superheater and economizer surfaces, in modern steam generators, the current method of rating appears to be inadequate.

Interesting illustrated lectures were delivered after dinner Friday evening by C. F. Harding, Head of the School of Electrical Engineering, on "Trends in Television" and by H. L. Solberg and G. A. Hawkins of the Mechanical Engineering Staff of the University, on "Researches in High Pressure and High Temperature Steam." Following the lectures the high pressure laboratory was visited, where work with the high pressure high temperature steam was in progress.

After adjournment of the Meeting Saturday morning the committee made a trip of inspection through the laboratories of the University.

Edgar Davis Edmonston

EDGAR DAVIS EDMONSTON, General Superintendent of Electric Operations of the Consolidated Gas Electric Light & Power Company of Baltimore and a life member of the American Institute of Electrical Engineers, died at Blue Hill, Maine, on August 29, 1937. He had left on his vacation in good health but was stricken by appendicitis followed by complications resulting in his death.

Mr. Edmonston was born in Washington, D. C., October 23, 1876, received his early education in Washington and graduated from Lehigh University in 1898 with degree of Electrical Engineer.

After his graduation he served several years with the U. S. Electric Lighting Company and Potomac Power Company of Washington, D. C., and with the Westinghouse Electric & Mfg. Company in the East Pittsburgh Shops and in the Design Dept. In 1900 he went with the Lackawanna Steel Company to take full charge of all electrical work in connection with their new steel plant at Buffalo, N. Y. There he was engaged in the engineering and construction of this plant and in the operation of the electrical equipment and material handling equipment. In 1905 he went with the American Construction Company of New Orleans as Chief Engineer in charge of all mechanical and electrical engineering work and of all construction work in connection with the building of an entire power and lighting system for the Consumers Electric Company of New Orleans. When this work was completed he entered the organization of W. S. Barstow & Company in charge of design and construction of two cement plants, one in Canada and the other in Virginia.

On July 1, 1908, he came to Baltimore as Superintendent of Construction of the Consolidated Gas Electric Light & Power Company of Baltimore, to take charge of the construction work of the company which was then on the threshold of major expansion and on January 1, 1911, he was made General Superintendent in full charge of all electric properties including engineering and construction, operation of steam plants, substations, transmission, distribution and installations. During his period of service the territory supplied by the company grew from a few localized sections of Baltimore City to an area covering 2137 square miles, while the volume of electricity sold increased from approximately $1,500,000 in 1908 to $23,000,000 in 1936.

Pennsylvania Association Convention

ATTRACTING an attendance of more than 700, the 30th Annual Convention of the Pennsylvania Electric Association, held at Bedford Springs, Sept. 8-10, was one of the most successful ever held by that organization.

As has been the case in recent years, much attention was devoted by the program committee to load building and customer relations, four full business sessions being devoted to these problems. Discussing the principles that should guide the electric industry in its historic policy of revising its rates downward when increased business or operating economies make the step possible, Ira L. Craig of Philadelphia, retiring president of the Association, gave warning that the present tendency to concentrate attention on reduction of residence rates might result in an unbalanced rate structure which could defeat the very purpose sought.

Mr. Craig pointed out that if the companies reduce residence rates, without due consideration to commercial and industrial rates, the latter may acquire an undue share of the burden of paying the nation's electric bill. "If we were to lose the system size factor and the system diversity factor through loss of industrial business," Mr. Craig warned, "costs would mount and, perforce, prices with them. For this to occur would be a catastrophe to residence service rates." Rate reductions to users, he pointed out, can come only as a result of improvements in the companies' net earnings, which result from economies derived from improved equipment or methods of operation or increased use of service by the customers.

Dennis J. Driscoll, chairman of the Pennsylvania Public Service Commission, praised the cooperation shown by the new Earle-appointed commissioners by Pennsylvania utility company representatives. Speaking frequently of conferences with Washington sources, Chairman Driscoll devoted most of his address to citing legal authorities on the scope of regulation.

George R. Conover, Managing Director, Electrical Association of Philadelphia, outlined the five-fold partnership embracing the manufacturer, distributor, dealer, contractor and utility company, and rigid utility support of local electrical associations as a force to tie together the various partners in the important business of selling the customer the advantages and benefits of electric appliances rather than just "kilowatt hours."

Francis McQuillan, chairman sales section, sponsored a commercial sales session with E. J. Ingram, chairman; an industrial sales conference, with C. F. Kells as chairman, and a women's session on "Kitcheneering Electrically," with Miss Clara H. Zillessen as chairman. The latter was attended by more than 150 women who heard discussions by Misses Ada Bessie Swann and Marion G. Kemp, and watched in operation a complete electric kitchen assembled in Philadelphia and trucked to Bedford.

"Calm and confident courage" in meeting the 1937-38 problems was the keynote of the acceptance speech of David A. Elias, vice president, Pennsylvania Power and Light Company, who was elected president of the association at the closing business session. Others elected were:

Vice Presidents, W. H. Swinney, Pittsburgh; M. H. Parkinson, Altoona, and Bernard P. Carey, Philadelphia.

Five men were named to the association's executive committee to serve for two years. They are Adam J. Althouse, Reading; H. B. Bryans, Philadelphia; Frank F. Henneman, Altoona; Louis B. Round, New Castle, and A. L. Hallstrom, Philadelphia. Re-elected were A. B. Millar, managing director, and Harold A. Buch, secretary-treasurer.

Rocky Mountain Convention

A GIGANTIC electrical merchandising activity campaign, covering Colorado, Wyoming, New Mexico and South Dakota, was launched at the convention of the Rocky Mountain Electrical League, held at Estes Park, Sept. 13-15. The drive, backed by a $125,000 advertising budget, is expected to result in the sales of $2,000,000 in electrical appliances during the next ninety days.

The two-day meeting brought together hundreds of members of the league's newly formed chapters to discuss business developments, load building, accounting and engineering operating problems. J. H. Jacobucci, manager of Utah Power & Light Company, was elected president to succeed Guy W. Faller, whose term of office expires January 1.

It is estimated that 10,000 executives and employees of 250 firms in the Rocky Mountain area will participate in the "Electrical Jubilee" sales campaign. All available radio stations in the region will be employed to further sales of appliances. Expositions, shows, contests, personal letters, newspaper advertising and reader stories in the press will be used in the promotion.

G. B. Buck describes the sales drive as one of the most ambitious merchandising projects in the area. The four-state movement will capitalize on national advertising by electrical manufacturers and synchronize local contests in such a manner that they will become a part of those operating on a national basis.

In order to stimulate interest and general participation in the three-month activity, the league plans several expense-paid trips to the Rose Bowl football game in January. Three trips will be awarded as prizes to sales people, merchandise managers and others who reach certain sales goals. The plan, in this respect, will extend to every appliance dealer, utility and distributor belonging to a local electrical league.

A high light of the convention was the council fire ceremonies emblematic of the Kee-Lo-Watt tribe, with officers officiating in the picturesque headdress and other regalia of the Indian.

The league's annual award of merit was presented to John E. Loiseau, Public Service Company of Colorado, for his work in consolidating the old Rocky Mountain Electrical Association with the Electrical League of Colorado, to form the present organization.

The four vice-presidents elected to serve with Mr. Jacobucci included H. E. Samson, Southwestern Public Service Company, Roswell, N. M.; Thomas W. Hughes, Sheridan County Electric Company, Sheridan, Wyo.; John E. Loiseau, Public Service Company of Colorado, Denver, and E. E. Brazier, General Electric Supply Corporation, Denver. W. E. Sterne, Arvada Electric Company, was re-elected treasurer and George E. Lewis executive secretary.

Empire State Association Convention

ONE HUNDRED AND FIFTY executives, junior executives and department heads of the various gas and electric companies of New York State met for the thirty-second annual convention of the Empire State Gas and Electric Association at Saranac Inn, on September 16 and 17.

Joseph P. Haftenkamp, who a few days before at a meeting of the Executive Committee, had been elected President, presided at the second session with Ernest R. Acker, Retiring President, presiding at the first session.

A splendid schedule of talks and papers covering problems of management, taxes, labor relations and various other pertinent subjects, was presented.

Herman Russell, President of the American Gas Association, spoke on the importance of close cooperation between gas and electric interests for the common good of customers and companies.

Mrs. Kenneth Norton, member of the Board of the Westchester Lighting Company, gave a splendid presentation of the women's place in the utility industry and outlined the many opportunities afforded the companies in a more skillful use of the many talents which women possess and can gainfully use.

Dr. Daniel Starch, member of the Board of the Associated Gas and Electric Company, spoke on the Gas Industry and outlined the opportunities ahead for that industry. He pointed out, with examples supported by carefully derived figures, the success some of the companies with which he was connected had in materially increasing their business and net revenues by a plan of sales analysis, and then action.

E. F. Jeffe, Vice-President of the Consolidated Edison Co. of N. Y., Inc., spoke on Power Competition with special reference to individual plants. A most enlightening exposition of the unfairness of this form of competition was given. He outlined the plans being used by his company for meeting this form of competition which in the recent past has been highly successful.

A. H. Kehoe, Vice-President of the Edison Electric Institute and Vice-President of the Consolidated Edison Company of N. Y., Inc., delivered a most interesting message for the Institute. A splendid résumé of the progress of the electric industry was outlined.

J. P. HAFTENKAMP
Newly elected president Empire State Association

Edward R. Eastman, Editor of *The American Agriculturist,* spoke on the value of electric service to the farm population. He made an urgent plea for the continuance of the present cooperative relationship between farmers, colleges and utility companies.

Reverend J. P. Boland, Chairman of the New York State Labor Relations Board, spoke on Fundamental Labor Relations, in which he stated as a fundamental truth that labor relations are human relations.

Hon. Mark Graves, President of the New York State Tax Commission, spoke on Utility Taxation and in an enlightening and interesting manner told of the distribution of the tax load with some pertinent suggestions as to a more equitable distribution.

The new officers of the Association, elected at the Executive Committee meeting on September 9, are:

President, J. P. Haftenkamp, vice-president, Rochester Gas & Electric Corp.
Vice-President, E. P. Prezzano, president, Westchester Lighting Co.
Treasurer, H. C. Davidson, secretary, Consolidated Edison Co. of N. Y., Inc.

RECENT E.E.I. PUBLICATIONS

POWER STATION CHEMISTRY—1937

E.E.I. Pub. E-10. A report of the Prime Movers Committee, Edison Electric Institute, 14 pages. Price 30¢ to members and their employees; 75¢ to non-members in the U.S.A.; 85¢ to foreign countries.

This report presents mainly the Subcommittee statements on the following subjects:

Review of member company statements on the use of materials for high-temperature service.

An analysis of member company's data on turbine blade deposits.

Coal classification and spontaneous combustion in coal storage.

Boiler corrosion wherein copper is involved.

Lubrication.

Methods of analysis.

Company statements of three specific cases of corrosion are also included.

COMBUSTION—1937

E.E.I. Pub. E-11. A report of the Prime Movers Committee, Edison Electric Institute, 43 pages. Price 80¢ to members and their employees; $2.00 to non-members in the U.S.A.; $2.15 to foreign countries.

This report contains statements by Subcommittee, Operating Companies, and Manufacturers on:

Pulverizers and Pulverized Fuel
Stokers
Combustion of Oil & Gas Fuels
Furnaces (other than pressure parts of water-cooled furnaces)
Mechanical Draft Equipment
Ash and Dust Elimination and Ash Disposal Equipment

TURBINES, CONDENSERS AND PUMPS—1937

E. E. I. Pub. E-14. A report of the Prime Movers Committee of the Edison Electric Institute, 30 pages. Price 60¢ to members and their employees; $1.50 to non-members in the U.S.A.; $1.60 to foreign countries.

This report contains statements by Operating Companies, Special A.S.M.E. Research Committee on Condenser Tubes, and Manufacturers on:

Turbine Operating Data for Year 1936
New Turbine Installations
Turbine Operating Experiences
Retubing and Relaning Condensers
Condenser Tube Materials
Condensers and Circulating Water Pumps
Test of an 80,000 kw, 1200 lb Turbine

POWER SALES ITEMS

AIR CONDITIONING

"Air Conditioning the Ford Engineering Laboratory," by Herbert E. Ziel. *Power*, October, 1937, p. 46. McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York City, Publishers.

Availability and cost of condenser water, plus the fact that steam power was close at hand, determined the selection of water-vapor as the refrigerant, direct-expansion cooling as the method, and steam turbines as the drive.

"Sears Conditions With Gas," by Orville Adams. *Power*, October, 1937, p. 58. McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York City, Publishers.

An ammonia plant, powered by gas engines, provides air-conditioning the year 'round at the Dallas plant. Ammonia is the refrigerant; a special "home-made" condenser-water cooler saved $10,000; and finned coils replace the usual air washer.

DIESEL ENGINES

"Diesel Engineers Meet," by J. W. Anderson. *Power*, October, 1937, p. 90, McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York City, Publishers.

Oil & Gas Power Division, ASME, holds annual meeting at Penn State. New engines sludge-gas engines, waste heat, lubricants and fuel oils included in program.

"Dual Fuel Diesel Sets Record." *Power Plant Engineering*, Technical Publishing Company, Monadnock Block, 53 West Jackson Blvd., Chicago, Ill., Publishers.

In service 98.5 per cent of the elapsed time for 9 mo. new Nordberg engine operates on gas at a fuel cost of 1.72 mills and a lubricating oil consumption of 5,483 hp. hr. per gal.

"Cosmopolitan Ice Plant Changes to Diesel Power," by W. Preston Russ. *Diesel Power*, September, 1937, p. 653. Diesel Publications, Inc., 192 Lexington Ave., New York City, Publishers.

The right Diesel engine with proper plant design and installation will give years of service at minimum cost.

"Hot Air From Diesels at H. D. Catty Plant," *Diesel Power*, September, 1937, p. 660. Diesel Publications, Inc., 192 Lexington Ave., New York City, Publishers.

Diesel engines supply both power and hot air for processing aluminum foil.

"Diesels Drive New Oil-Well Drilling Rig," by Denis S. Sneigr. *Diesel Power*, September, 1937, p. 661. Diesel Publications, Inc., 192 Lexington Ave., New York City, Publishers.

Diesel drive saves water, uses less fuel and avoids fire risk.

INDUSTRIAL ELECTRIFICATION

"Industrial Electrification," *Electrical World*, September 11, 1937, p. 102. McGraw-Hill Publishing Company, 330 West 42nd St., New York City, Publishers.

Four items which contain ideas for power sales:

Anneal 35 tons daily in automatic furnace.
Shipbuilders favor electric welding.
Spot-welding data for non-ferrous metals.
Electric heaters singe cotton cloth.

"Industrial Electrification," *Electrical World*, September 25, 1937, p. 80. McGraw-Hill Publishing Company, 330 West 42nd St., New York City, Publishers.

Four items which contain ideas for power sales:

"Electric Boiler" solves tough problem.
Electricity saves in firing enamel.
German formula for coal face lighting.
Dairies adopt electric boilers.

IRON & STEEL INDUSTRY

"Abstracts of Papers to Be Presented Before the A. I. & S. E. Convention, Chicago, Illinois, September 28, 29, 30, Oct. 1, 1937." *Iron & Steel Engineer*, September, 1937. Association of Iron & Steel Engineers, 1018 Empire Bldg., Pittsburgh, Pa., Publishers.

"Steam Power Developments," by Charles W. E. Blarke.
"Selection of Insulated Cables for Steel Mills," by F. L. Aime, S. J. Rosch, and R. B. Steinmetz.
"Protective Atmosphere for Annealing Furnaces," by A. N. Otis.
"Steam Generation from Gas Engine Exhaust in America," by T. A. Lewis.
"Low Voltage DC and AC Systems in Steel Plants," by Donald Nelson.
"Welding Economics and Application," by E. W. P. Smith.

"Turbine Developments—Their Application in the Steel Industry," by C. B. Campbell, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. *Iron & Steel Engineer*, September, 1937, p. 48. Association of Iron & Steel Engineers, 1018 Empire Bldg., Pittsburgh, Pa., Publishers.

Trends in the steam turbine field and developments toward greater reliability in operation.

NATURAL GAS

"Burning Natural Gas," *Power Plant Engineering*, October, 1937, p. 588. Technical Publishing Company, Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill., Publishers.

University of South Dakota converts two 200-hp. boilers from stoker to natural gas firing. Boiler output increased and fuel costs reduced. Savings estimated to pay for conversion in less than 2 yr. under average conditions.

PAPER & PULP MILLS

"Union Bag & Paper Proves Faith in Southern Pine by Adding Two Units to Savannah Plant," by D. G. Moon. *Southern Power Journal*, October, 1937, p. 54. W. R. C. Smith Publishing Co., 1020 Grant Building, Atlanta, Ga., Publishers.

Construction has not stopped on this Kraft plant since the first unit was started in July, 1935. The first 130-ton project was followed by a second, and now a third unit is scheduled for completion this month. The total capacity of the plant will be 700 tons of pulp and 600 tons of Kraft bag and wrapping paper per day.

"Onions & Power, Farmersville, Texas, Is Proud of Both," by Orville Adams. *Southern Power Journal*, October, 1937, p. 60. W. R. C. Smith Publishing Co., 1020 Grant Building, Atlanta, Ga., Publishers.

Good design, ample engine and generator capacity, together with efficient operation and a sound financial policy have resulted in excellent performance.

"Diesel, Steam and Hydro-Power Hinsdale Paper Mill," *Diesel Power*, September, 1937, p. 647. Diesel Publications, Inc., 192 Lexington Ave., New York City, Publishers.

Description of plant which parallels Diesel, steam and hydro-power.

POWER PLANTS

"The Chevrolet—Forge High Pressure Plant," by W. J. Massey. *Power Plant Engineering*, September, 1937, p. 516. Technical Publishing Company, Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill., Publishers.

New 625-lb., 725-deg. F. power plant acts as efficient top for old plant while the bleeder-condensing turbine gives flexibility. Two 170,000 lb. per hr. pulverized coal fired boilers and one 7,500-kw. turbine are installed in Detroit plant.

STATIC ELECTRICITY

"Static Electricity in Industry," *Power*, October, 1937, p. 65. McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York City, Publishers.

In many industrial processes, static electricity is a possible menace. This article shows how it can be eliminated.

STRIP MILLS

"Gary Sheet & Tin Division, Carnegie-Illinois Steel Corp." *Iron & Steel Engineer*, September, 1937, p. G-1. Association of Iron & Steel Engineers, 1010 Empire Bldg., Pittsburgh, Pa.

Description and plan view of 80" continuous strip mill.

"Inland's 76" Continuous Strip Mill," *Iron & Steel Engineer*, September, 1937, p. I-1. Association of Iron & Steel Engineers, 1010 Empire Building, Pittsburgh, Pa., Publishers.

Description and plan view of the strip and tine mills.

TURBINES

"Modern Turbines," by L. E. Newman, *Power Plant Engineering*, September, 1937, p. 536. Technical Publishing Company, Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill., Publishers.

This is the first of a new series of articles discussing the basic elements and the engineering aspects of modern steam turbines.

TURBINES

"Modern Turbines," by L. E. Newman, *Power Plant Engineering*, October, 1937, p. 585. Technical Publishing Company, Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill., Publishers.

The first article of this series which appeared last month outlined a few fundamental elements of turbines. This was preliminary, quite general in fact; now, in this article the author gets down to brass tacks and discusses the various types of turbines available and to what purpose they can be applied.

Trouble Analysis

(*Continued from page* 430)

22. *"Primary Cut-Outs: Fuse Links"* is an evidence heading provided for the entry of troubles confined to the fuse link itself, and *does not include* normal fuse blowings due to overloads or short circuits *which are definitely* located elsewhere on the system. This evidence heading is used, however, for troubles in which the fuses blew due to an unknown cause, even though the cause, if known, might not have been local to the fuse link.

23. *"Customer's Service Equipment"* is an evidence heading provided for the entry of troubles on customer's primary service equipment caused by the customer himself, and affecting either the Company's system or other customers, or both.

BIBLIOGRAPHY

1. "Outage, Service Standards and Investment," paper by S. M. Dean, Chief Assistant Superintendent of Electrical System, Detroit Edison Company. Given before Edison Electric Institute at Chicago, June 6, 1933, E. E. I. BULLETIN, July, 1933.

2. "Operating Data That Pay," by J. M. Flanigen, Georgia Power Company, in *Electrical World,* April 27, 1935.

3. "Economic Engineering," by W. F. Sims, Chief Electrical Engineer, Commonwealth Edison Company, in *Electric Light and Power,* June, 1936. Page 46.

4. "Uniform Records of Electrical Operation of Power Systems," Serial Report of the Electrical Apparatus Committee, July, 1929, National Electric Light Association, Publication No. 289-52.

5. "Standardization of Line Material and Construction," by Howard P. Seelye, Detroit Edison Company. Article in *Electric Light and Power,* September, 1935.

CONVENTIONS AND MEETINGS

OCTOBER

1	American Gas Association, Cleveland, Ohio.
1-2	Prime Movers Committee, Purdue University, Lafayette, Ind.
9	Accident Prevention Committee, Cleveland, Ohio.
11-12	Electrical Equipment Committee, Chamber of Commerce Grill, Terminal Tower Building, Cleveland, Ohio.
11-15	National Safety Council Congress, Kansas City, Mo.
12-13	Transmission and Distribution Committee, Chamber of Commerce Grill, Terminal Tower Building, Cleveland, Ohio.
17-20	National Electrical Wholesalers Association, Cleveland, Ohio.
21-23	Indiana Electric Association, French Lick Springs Hotel, French Lick Springs, Ind.
24-29	National Electrical Manufacturers Association, Chicago, Ill.
27-29	National Paint, Varnish and Lacquer Association, Cincinnati, Ohio.

NOVEMBER

5	Sales Committee, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.
8-10	Accounting Committee Conclave, Book Cadillac Hotel, Detroit, Mich.
11-13	Wisconsin Utilities Association, Electric Section, Commercial and Technical Divisions, Pfister Hotel, Milwaukee, Wis.

DECEMBER

6-7	Prime Movers Committee, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.
6-10	American Society of Mechanical Engineers, New York, N. Y.

JANUARY

19-21	American Society of Civil Engineers, New York, N. Y.
24-26	National Warm Air Heating and Air Conditioning Association, New York, N. Y.
24-28	American Institute of Electrical Engineers, New York, N. Y.
24-28	International Heating and Ventilating Exposition, New York, N. Y.

Wisconsin Association Accounting Section

FOUR major changes in methods of keeping utility records which will result in more effective utility regulation were discussed by Chairman Fred S. Hunt, Wisconsin Public Service Commission, at the annual convention of the accounting section of the Wisconsin Utilities Association held Sept. 24-25 at Green Lake.

Other speakers included C. E. Kohlhepp, vice-president and treasurer of the Wisconsin Public Service Corporation and president of the Wisconsin Utilities Association; R. E. Moody, vice-president Wisconsin Gas & Electric Company, who declared that utilities can benefit the public most by developing more widespread salesmindedness; Grant Chandler, Arthur Anderson & Company, Chicago, who spoke of the significance of a certificate of an independent audit, and Frank A. Newton, Commonwealth & Southern Corporation, who discussed the outlook for the utility industry.

J. J. Feeney, Madison Gas & Electric Company, was elected to the chairmanship of the accounting section and N. H. Buckstaff, Northern States Power Company, was named vice-chairman.

West Penn to Stop Merchandising at End of Year

AFTER many years of direct merchandising, West Penn Power will discontinue the sale of electrical appliances and lamps on January 1, 1938.

The Company believes, according to an official announcement, that other merchants are now able and willing to display and sell all electrical appliances effectively, so that the use of electricity, West Penn's primary product, will increase in the future as it has in the past. West Penn will continue to advertise and demonstrate electrical appliances just as actively as it ever has, but the actual sale of such items will be left entirely to dealers.

When West Penn first started to merchandise, the number of dealers handling appliances was much smaller than it is today, and the primary responsibility for popularizing new appliances as they were developed was taken by the electric utility. Today, with the wide acceptance of the electric iron, washer, radio, refrigerator, and small appliances, and the growing popularity of the electric range, the roaster, the ironer, the electric water heater, and the I. E. S. lamp, it appears possible for West Penn to withdraw from the active sale of all such appliances.

In regard to service on electric appliances, West Penn will continue to accept full responsibility for providing expert and prompt service on all equipment sold currently or in the past by West Penn Appliance Company.